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In the July issue of AVIATION, Mr. Weick of the National Advisory Committee for Aeronautics presented his views on the ideal airplane to meet the needs of amateur pilot and private owner. In this article, Professor Koppen approaches the problem from a somewhat different angle, and presents another possible solution in an airplane with a novel type of landing gear and a simplified system of control.

Happier Landings

A new type of airplane for a new type of pilot

By Otto C. Koppen

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MR. WEICK and his associates at the National Advisory Committee for Aeronautics have designed a plane and tested a method of landing it in which the pilot simply pulls the longitudinal control full back and holds it there. (AVIATION, July, 1934). The airplane then achieves equilibrium at a predetermined angle of attack and proceeds at a known speed along a path at a known angle with respect to the ground. The pilot needs only enough skill to keep it traveling straight into the wind. No attempt is made (or can be made, since the elevator is hard back during the glide) to flatten out before contact with the ground. The landing gear is depended upon to absorb the entire impact.

Theoretically this is simple enough, but practically there are difficulties. In the first place, the angle of equilibrium in the glide depends upon factors which are not under the control of the designer, particularly those that have to do with the distribution of load in the machine. In the second place, an airplane seldom lands in perfectly calm air, and when the longitudinal attitude is disturbed by gusts it tends to oscillate in pitch. Since the longitudinal control is all the way back, the pilot is therefore helpless to correct this condition. Obviously then, if the plane is thrown into oscillation just before contact is made with the ground, serious damage may result.

Rather than limit the pilot's control over the longitudinal motion of the airplane in such fashion, it would seem more desirable to alter the design so that the pilot could bring the ship to the ground by simple reference to some normal visual index—in this case the natural horizon. The first thing that students learn is to hold the nose of the airplane in a definite relation to the horizon in flight, and that same ability should be all that is necessary for making landings. In other words, it should be possible to land with the longitudinal axis of the airplane at a constant angle to the horizon, leaving at the same time, full control of pitching motion in the hands of the pilot. It is up to the designer, therefore, to arrange the airplane so that the normal angle of attack with the engine throttled is equal to the normal gliding path angle (the angle whose tangent is the lift-drag ratio). Thus to land, the pilot simply throttles the engine and holds the longitudinal axis of the plane in its normal position with respect to the horizon, and the plane settles along a predetermined path at a predictable speed.

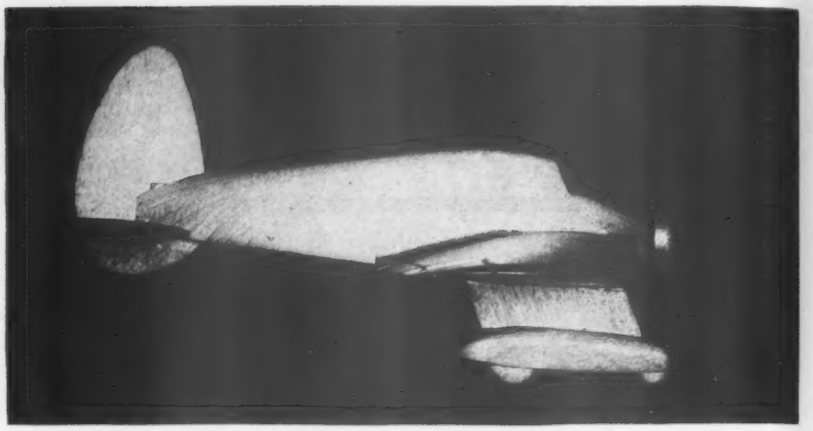
If the plane is to be landed with its longitudinal axis horizontal, the normal type of landing gear is clearly unsatisfactory. In an ordinary landing the flight path is parallel to the ground, and the conventional landing gear is arranged so that the wing is at its angle of maximum lift when the airplane is at rest on the ground. For the proposed type of landing, all of the elements of the landing gear should be at the same level, and the shock absorbing struts so arranged that the axis of the plane remains level during the entire stroke.

Model tests

In order to be able to present more concrete evidence of the practicability of the design changes proposed in this paper, I was able, through the assistance of the Department of Aeronautics of the Massachusetts Institute of Technology, to build and test in the wind tunnel a model of an airplane which would have the proposed characteristics.

The model is 1/12 scale of a 1,600 lb. two-seater, low-wing monoplane. The estimated high speed with 110 hp. is 113 m.p.h. The wing is equipped with flaps having a chord of 10 per cent of

the wing chord and having a downward travel of 90 deg. The chief difference from the conventional airplane lies in the landing gear. Two streamlined housings under the wing each contain two wheels. Since the rear wheels are located behind the center of gravity the machine will normally rest on all four wheels. There is no tail skid, but the lower projection of the fin would be reenforced against breakage by accidental contact. With such a landing gear, brakes could be applied without danger of nosing over, and there would be no possibility of being lifted by a puff of wind just after landing. Take-off would also be facilitated by the horizontal attitude of the machine. Maneuvering on the ground should not be difficult since, with rear wheels located fairly close to the C.G., the front wheels could be lifted by the elevators for sharp turns.



Side view of wind tunnel model showing arrangement of tandem landing wheels. Note the absence of rudder.

Landing characteristics

Wind tunnel tests show that the proposed type of landing would be feasible. With the flaps down 90 deg., the angle of attack at which the path angle is equal to the angle of attack is 8.6 deg. The drag upon which this calculation is based includes an estimate of the negative thrust of the wind-milling propeller. The lift at this angle of attack gives an estimated speed of 44.5 m.p.h., and the sinking speed corresponding to the path angle and speed is slightly under 10 ft. per second.

The proposed shock-absorber travel, not including the deflection of the tires, is 2 ft. The load acting on the airplane at a vertical velocity of 10 ft. per second would be only about 0.8 g.

In order to avoid flying continually with the landing gear in the extended position, a latch could be used to hold the gear up until the pilot is ready to land. An automatic release could be connected to the engine control so that the wheels drop down when the throttle is pulled back. The design is such that it would be possible to land safely in emergencies with the wheels up if the pilot neglected to close the throttle.

Recovery from stall

In discussing simplified landings the question of the accidental stall always comes up. The normal airplane invariably dives when stalled. This is usually explained as the natural tendency of a stable airplane to regain its flying speed. Since, however, the airplane goes into a nose-down attitude during recovery the tendency is dangerous and must be eliminated. There are two elements of stalled flight that produce diving moments. The wing center of pressure moves back an amount ranging from 15 to 20 per cent of the chord, and the downwash is reduced over the central portion of the wing. In order to provide more longitudinal control at the stall, it is necessary to increase the angular range of the tail. In the conventional arrangement of tail surfaces the maximum change of angle is limited. It would seem more desirable to use a single movable surface whose angular range is limited only by the stalling of the surface itself. To overcome the usual objection of supersensitivity of control a differential linkage should be used. The design of a linkage would not be complicated because the proposed type of landing gear makes it unnecessary to get large downward elevator deflections to raise the tail on the take-off. Balance and free control stability could be acquired by the use of springs attached to a trimming lever.

If, as has been shown by the wind tunnel tests, the airplane can be held in equilibrium at high angles of attack, the next problem is to determine the rate of descent at the angle of attack above the stall at which the airplane longitudinal axis is again level. Although wind tunnel tests are somewhat uncertain at angles of attack above the stall, the tests indicate that the airplane would again be in equilibrium at an angle of attack of about 19 deg. At this angle the lift is lower than before, and the speed along the path is increased to 52 m.p.h. The sinking speed then would be about 25 ft. per second and the landing shock is estimated to be 5 g. or about six times its previous value. A landing gear could be designed without difficulty which would carry this load without damage.

In the proposed type of landing, the usual difficulty of stalled flying would be eliminated. At angles of attack above the stall, lift decreases as the angle of attack increases, and therefore longitudinal control is reversed. In making a stalled landing the control must be pushed forward in order to flatten out the flight path. This is an unnatural motion. In landing with the airplane axis horizontal, however, the pilot is merely maintaining a constant, if unstable, equilibrium and the control motions are not reversed. For certain types of landings it might be desirable to deliberately stall the airplane to take advantage of the steeper flight path obtained in stalled flight.

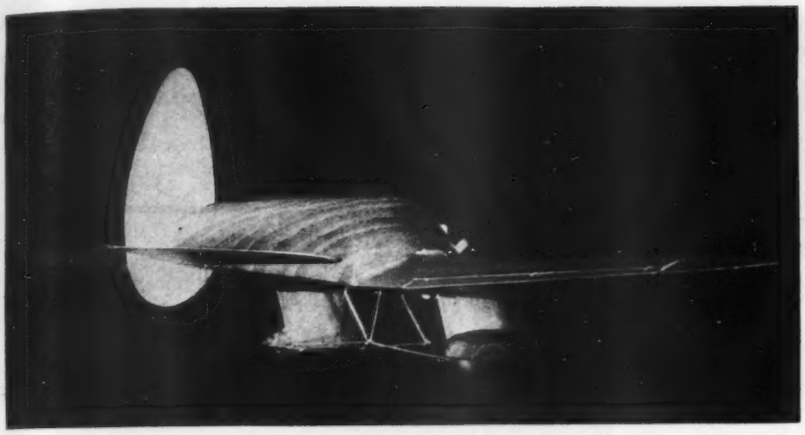
Lateral control

So far, the question of trouble with lateral motion has been completely avoided. That is the usual method. By common consent, anything that happens to make the pilot lose control at high angles of attack is the pilot's fault. The pilot is generally expected to know better than to require control over the rolling and yawing motion of the airplane at angles of attack above the stall.

One of the first difficulties encountered at high angles of attack is that the damping of yaw changes sign. This means that if the machine has a yawing velocity, as in a turn, a moment is generated which tends to make it turn faster. Opposite rudder is then required in order to turn at a constant rate. In addition, a rolling moment is caused by the yawing velocity, due to the difference of relative speed of the two wing tips. To balance this rolling moment, the ailerons must be set against the turn. This setting of the ailerons creates a yawing moment which also tends to make the airplane turn faster, and more rudder is required to balance this additional moment. Normal rudder power is not sufficient to cope with the situation and the airplane goes into a turn which ends up in a tight spiral or a spin.

There are two ways of relieving this condition. We may either increase the pilot's control power or decrease the moments tending to deviate the airplane from its path. The former method has received most of the attention of research workers but the latter seems more feasible for the amateur pilot. The first step is to insure that the damping of yaw remains negative at all angles of attack at which it is possible to fly the airplane.

The process of providing for a negative damping of yaw is a simple one. The size of the vertical tail is increased until oscillation about the vertical axis is eliminated. In some cases, it is im-



The three-quarter rear view shows undercarriage bracing. The gear in both cases is in the normal flight position.

possible to change the sign of the moment by this means, because the vertical tail area becomes prohibitive in size. Other means must then be resorted to, such as increasing the moment arm of the tail or modifying the wing section, so that its lift is decreased and its drag increased at high angle of attack. To produce the desired results on the model tested, the effectiveness of the vertical tail had to be increased to about twice the average normally used.

After a negative damping of yaw has been assured, it is still necessary to modify the airplane to reduce the large detrimental aileron yawing moments which occur at high angles of attack. The National Advisory Committee for Aeronautics has pointed the way to a solution of this problem. (NACA Report No. 419.) If short, wide ailerons are used with an extreme differential motion so that the up aileron has a maximum travel of about 80 deg. and if in addition, the neutral position of the ailerons is above the chord line, opposite yawing moments may be entirely eliminated. In fact, large yawing moments may be produced in the direction of the turn.

If short, wide ailerons having a neutral position above the chord line are to be used, it is desirable to devise a method whereby the neutral position of the ailerons is varied according to the angle of attack at which the airplane is flying. This may be done by connecting the ailerons to the elevator control so that both ailerons move up as the control is brought back. The aileron position should be located for the power-off condition.

The need for a powerful rudder has now disappeared. In ordinary flying it is used only to overcome the damping of yaw while turning. If controllability in sideslip is still required, however, it is necessary to retain the rudder since the yawing moment due to angle of yaw has been increased by the greater fin effectiveness and because the yawing moment due to the ailerons has been changed in sign. In fact, it is doubtful whether an airplane with efficient ailerons can be sideslipped at all unless the rolling moment due to angle of yaw of the airplane is very small. Sideslip, however, may be considered as an unnecessary maneuver if the airplane is designed to be landed in the manner described.

After the positive damping of yawing velocity and the adverse yawing moment of the ailerons have been eliminated, it is still possible for the amateur pilot to get into trouble by misusing the rudder. If the machine is turning at a high angle of attack and the pilot desires to turn more rapidly, he will usually apply too much rudder. Overcontrolling of the rudder is especially possible at low altitudes when a large angle of bank seems dangerous to the amateur pilot. A skid will then result which will produce two rolling moments tending to raise the outside wing, one due to the sideslip and the other to the yaw, both of which increase with angle of attack. In addition, at high angles of attack the damping of roll is small and in some cases may be positive. The rolling moments induced by the skid then may produce a high angular velocity of roll. Then if the pilot does not counteract the rolling moment rapidly enough, or if his ailerons are not powerful enough to do so, the rolling moment will produce a yawing moment which retards the low wing. This combination of moments will again produce a spiral motion, and the airplane may hit the ground before the pilot can straighten it out.

Misuse of rudder

Another way to get into trouble is to misuse the rudder in a steeply banked turn. The angle of the flight path depends upon the ratio of the difference of thrust and drag to the lift component normal to the ground. If, while turning at high angles of bank, the drag becomes larger than the thrust, the flight path will be inclined downward. This will become apparent to the pilot by a dropping of the nose relative to the horizon. If the turn is being made at low altitude, the pilot will have a strong temptation to apply top rudder in order to bring the nose up. Although the nose may be raised by this method, the flight path is still downward. The angle of yaw produced may again throw the machine into a dangerous attitude from which the pilot may not be able to recover before hitting the ground.

In order to turn an airplane, a component of lift must be produced in the direction in which the flight path is to be curved. The function of the rudder while turning is not to be confused with the action of the front wheels of an automobile. The rudder merely overcomes the damping moment due to the angular velocity of yaw, whereas the front wheels actually provide the force which changes the direction of the car. The airplane is turned only by changing the direction of the lift of the wings. It is true that this may be done with the rudder by skidding the airplane and using the rolling moment due to sideslip to bank the wings. In that case, however, the rudder is assuming the function of the ailerons.

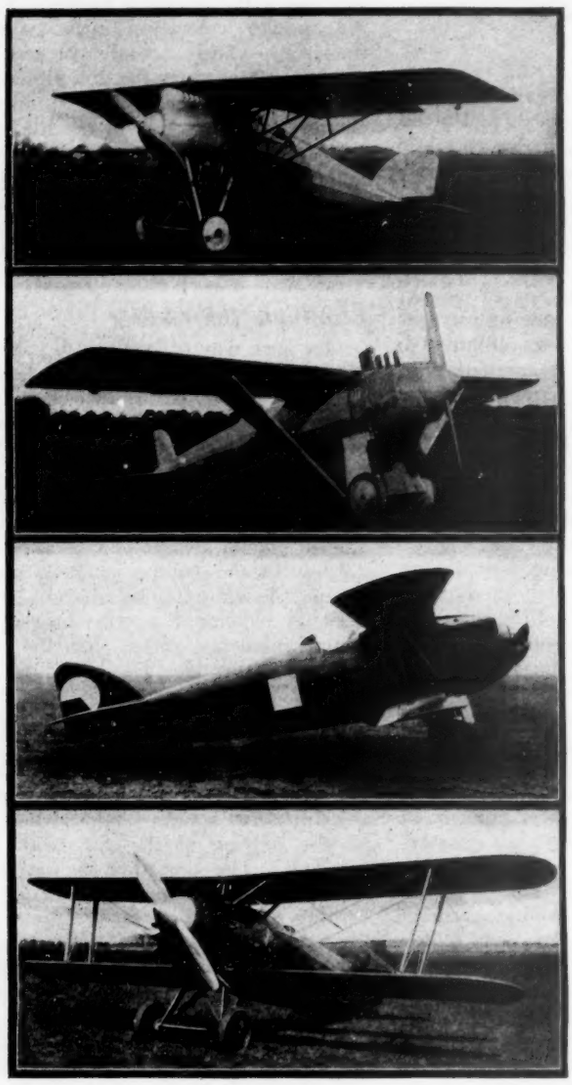
Eliminate the rudder

One sure way of keeping the amateur pilot from getting into trouble through improper use of the rudder is to eliminate it. While turning, the damping of yaw would then be balanced by a yawing moment due to sideslip. The sideslip would always be toward the low wing and the rolling moment due to sideslip would always be opposite in direction to the rolling moment due to angular velocity. The ailerons would need to balance the difference of the rolling moments, rather than the sum.

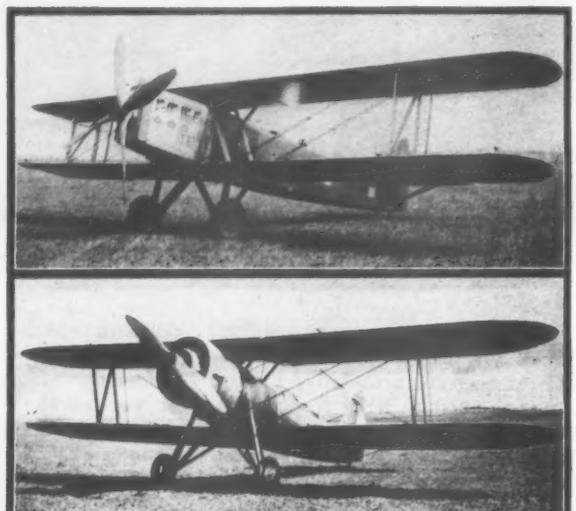
With the rudder eliminated an airplane could be controlled solely by a wheel mounted on a post, although a method of trimming the machine directionally might be desirable to avoid flying with one wing low if the rotation of the slipstream is not completely balanced by the portion of the fin below the fuselage. The direction of the flight path would be completely controlled by turning the wheel and at the same time, the nose would be kept in its proper relation to the horizon by a fore-and-aft motion. A single foot brake and an engine accelerator might then be substituted for the unnecessary rudder pedals for better control on the ground.

Such an airplane could be built with the aid of information already available and would eliminate to a great extent the expensive and tiresome training and practice now required and at the same time, would be safer for the amateur to operate. Maneuvers such as rolls, spins, sideslips, cross-wind take-offs and landings could not be accomplished in this airplane, but the type of pilot for whom it is designed would not perform such maneuvers regardless of the airplane in which he might be flying.

Left: An early post-war type, the S-1, produced by Central Aircraft Works (Czechoslovakia) notable for its wooden monocoque fuselage.



Evolution of pursuit by Letov (Czech). From top to bottom: The S-3 (1922) and the S-8 (1924), both showing the influence of French design. The S-20, a transition type, powered with the 300-hp. Hispano. S-31, among the first of the air-cooled models—this machine is powered with a Pratt & Whitney Hornet. Right: The last word, The S-231 multi-gun fighter.



Letov reconnaisance and training machines. From top to bottom: The S-16 series lends itself to a wide range of uses—this Model S-616 with geared Hispano engine functions as a day bomber. High performance, two-place pursuit, the S-328. For training, the S-218 with nine-cylinder Walter engine.

Made in Czechoslovakia

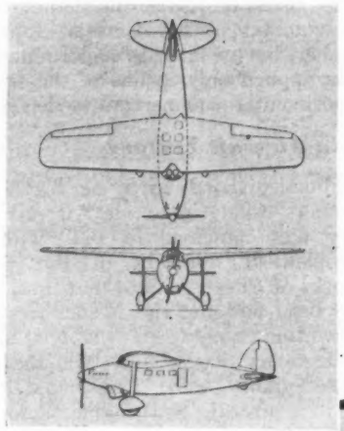
Our study of the military air forces of the world has so far covered the major power of the East and the West. The spotlight now turns toward Central Europe and the activities of Czechoslovakia, Jugoslavia, and Roumania. The author, a former engineer of the Junkers Company now resident in Paris, has contributed widely to the technical aeronautical press abroad.

The Equipment of Air Forces

THE LITTLE ENTENTE

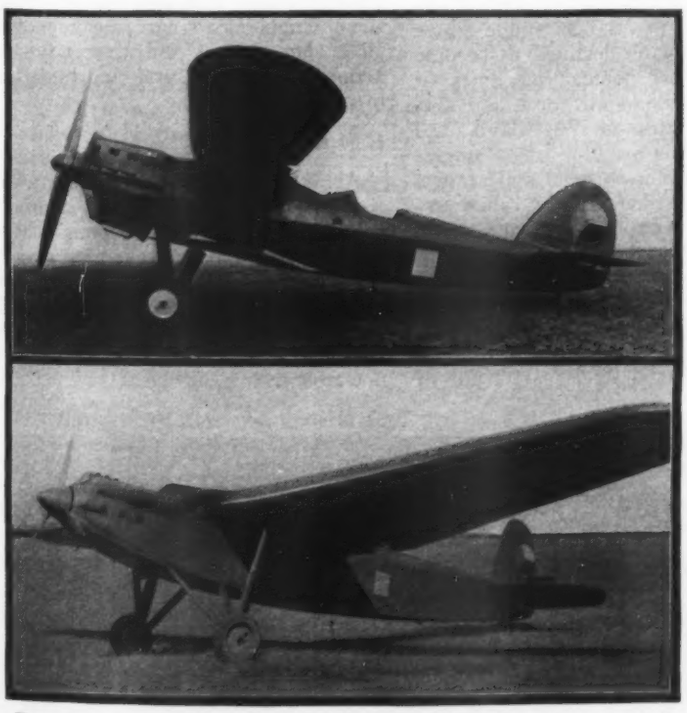
By Dr Alois Robert Böhm

THE COURSE followed by military aeronautics in Central Europe since the close of the World War has been largely directed by the complex political and economic relationships that the countries of the Little Entente (Czechoslovakia, Yugoslavia, Roumania) bear to each other and to the larger European powers. At the outset the influence of France was predominant in all three countries. In fact, the first flying squadrons organized in each of them after the Treaty of Versailles were equipped with French planes and engines and commanded by French officers, and for some years thereafter Nieuports, Spads, Breguets, and the later Potez machines figured prominently in the equipment rosters. Even now there are indications that some degree of co-operation still exists between the air staffs of France and those of the Little Entente countries. French designs are still common, but there have been inroads made by German, Italian, British and even American equipment and each of the nations have from the beginning made every effort to build up aircraft industries of their own. Particularly in Czechoslovakia have French equipment manufacturers met strong competition from local sources.

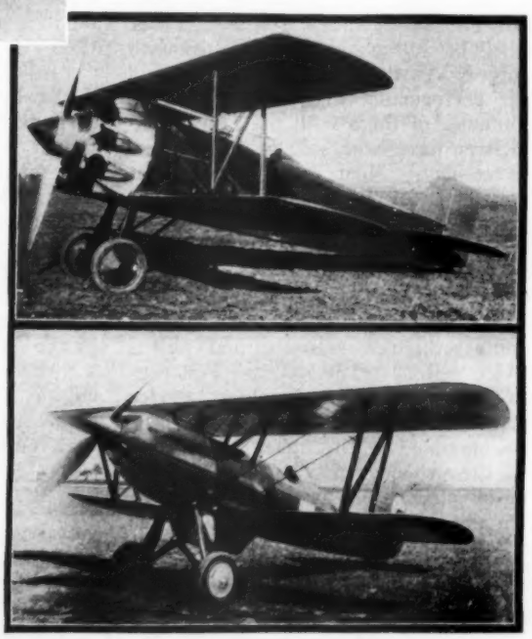


The Czechoslovakian Republic

Czechoslovakia, the most important industrial state of the group, has, since 1918, built a completely new military



Two types by Aero Aircraft (Czech). Top: Two place general purpose machine, the A-100. Bottom: For long range night bombardment, the Aero 42.



Avia (Czech) products. From top to bottom: Three-view sketch of a convertible reconnaisance and day bomber, the Avia 156 with Avia 12 Ybrs engine. The BH-33, longtime the backbone of Czechoslovakian air forces. A modern pursuit type in the British manner, the Avia 534 with twelve-cylinder liquid-cooled engine.

machine. From an aeronautical standpoint the new state was fortunate in that a large share of the former Austro-Hungarian industrial system was acquired when the new frontiers were laid.

As early as 1919, the first Czechoslovakian military airplane took the air, a design of one Smolik, built by the shops of Central Aircraft Works. This two-seater reconnaissance machine was notable for the early usage of a wooden monocoque fuselage. With its 230 hp. Breitfeld and Danek "Hiero" engine it showed a top speed of 121 m.p.h. and an ability to climb to 10,000 ft. in twelve minutes.

Letov Works

In 1919 the Central Aircraft Works became the Letov Military Aircraft Works and since that time this establishment has turned out some 40 military models. These have included fighters, reconnaissance and training types.

The first two of the fighter series, the S-3 and the S-8 (1922 and 1924), were very obviously influenced by French design technique. They were monoplanes of the parasol and high wing variety, respectively, powered with water-cooled engines. The later S-20 had some of the earmarks of the French Spad. It was powered with a 300 hp. Hispano engine. A number of these machines were used not only by the Czechoslovakian Air Force but also by the military squadrons of Lithuania. Water-cooling gave way to air-cooling for pursuit use in the S-31, regularly equipped with the Walter-built Jupiter. Later models of this machine were fitted with Pratt & Whitney Hornet engines and their performance materially increased. A number of them with the Hornet installation have been sold to the Chinese Government. Most recent Smolik design for Letov is the single-seater biplane S-231, powered with a supercharged Bristol Mercury IV-S2 engine delivering 560 hp. at 15,700 ft. This machine shows a top speed of 214 m.p.h., climbs to 16,400 ft. in eight minutes, thirteen seconds, and has a service ceiling of 30,500 ft. For regular use with Czechoslovakian service squadrons it is fitted with four machine guns mounted in the upper wings outside the propeller disk, and fired by a Pantof pneumatic synchronizing gear.

In the reconnaissance class the S-16 with a 450 hp. Lorraine or a 500 hp. Hispano (Model S-116) is the machine used by the Czechoslovakian, Turkish and Yugoslavian air forces. The Models S-616 (geared Hispano 650 hp.), the S-716 (geared Skoda 500 hp.) and the S-816 (Praga ES 550 hp.) are modifications of this same general type and are used both for reconnaissance and for day bombing. This machine appears both as a land plane and as a twin-float seaplane. Its performance ranges from 143 to 161 m.p.h., top speed, climb to 16,400 ft. in 19 to 23 minutes, with service ceiling ranging between 21,300 ft. and 23,900 ft., the variations depending upon the engine installation and the degree of aerodynamic refinement. Models S-128 and S-228 are reconnaissance biplanes with air-cooled Jupiter or Mercury engines. A modification of this model, the S-328, equipped with the Bristol Pegasus or the Hispano Xbrs engine of 650 hp., can be used for high performance two-seat pursuit, army cooperation, day bombing, etc.

For training purposes Letov has produced two small biplanes, the S-18 and the S-218 of conventional appearance. The S-218 is powered with a nine-cylinder radial air-cooled engine.

As a general rule, planes turned out by the Letov plant are of duralumin framing with fabric covering, except for fuselages, which are of the usual welded steel tube type. Some work has been done with all-metal duralumin wing construction in the German-Rohrbach manner, but so far this construction has been applied only to one of the smaller experimental commercial models.

Avia Aircraft Factory

Founded shortly after the War by the brothers Bondy, the Avia Aircraft Factory was combined in 1927 with the aeronautical interests of the Skoda Works of Pilsen. Up to that time, Avia had been building the French designed Dewoitine single-seat, fighter monoplane under license. In 1930 the combined plants were transferred to a modern aircraft and engine factory in Cakovice, near Prague.

In 1927-28, working to designs produced by engineers Benes and Hajn, Avia produced the BH-33 single seater fighter, an airplane destined to become one of the most popular machines of the Czechoslovakian air force and also sold in quantities to Yugoslavia and Roumania. This machine was a single-bay biplane of conventional appearance, powered with a nine-cylinder radial air-cooled engine. Later it was superseded by the Avia 534, a biplane powered with a twelve-cylinder V-type liquid-cooled engine. The antecedents of this machine are obviously British both in general outline and in construction. The wings have riveted steel spars made of formed sheets in the British manner. The fuselage is of steel tubing riveted together. The forward part is covered with electron sheet in removable panels and the rear portion is fabric covered.

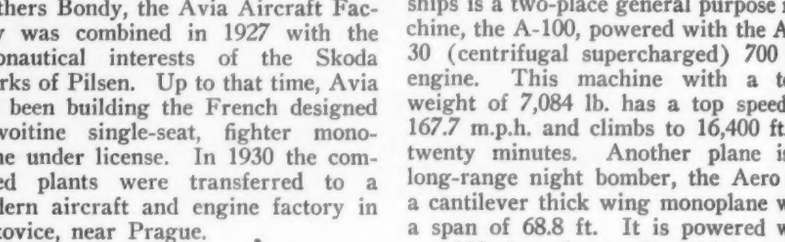
Avia also manufactures two types of bombers, the Avia 156, a high performance reconnaissance and day bomber, and the F-39 heavy bomber. The first is a single-engine high-wing monoplane with a dural fuselage and with riveted steel wing spars and ribs. Armament consists of two machine guns, in the rear cockpit, and two fixed guns mounted in the wings outside the propeller disk. Powered with an Avia 12 Ybrs engine of 860 hp., at 2,400 r.p.m., the machine shows a top speed of 220 m.p.h., climbs to 16,400 ft. in seventeen minutes, has a service ceiling of 22,900 ft. The gross weight is 3,860 lb. The F-39 bomber is a modification of the three-engined Fokker F-IX which Avia also manufactures under license as a commercial plane.

Aero Aircraft Works

Another manufacturer of long standing is Aero Aircraft Works, which produced a small single-seat fighter as far back as 1921. Among its more recent ships is a two-place general purpose machine, the A-100, powered with the Avia 30 (centrifugal supercharged) 700 hp. engine. This machine with a total weight of 7,084 lb. has a top speed of 167.7 m.p.h. and climbs to 16,400 ft. in twenty minutes. Another plane is a long-range night bomber, the Aero 42, a cantilever thick wing monoplane with a span of 68.8 ft. It is powered with an 800 hp. Isotta Fraschini water-cooled engine. This machine established some notable load carrying records in 1931, but it has only recently been adopted by the air force and turned out in quantity.

C.M.K.D.

About 1930 the Ceskosko Moravska-Kolben-Danek established its own aeronautical department with personnel recruited from the Avia Works. So far they have produced three types of military machines: a primary training biplane (the BH 39 with a 120 hp. Walter engine), the advanced trainer BH 41 powered with a 300 hp. Hispano, and a



Yugoslavian Reconnaissance—Rogozarski biplane, Walter engine.

single-seat fighter, designated as the BH 44. The latter is obviously an improved descendant of the Avia BH 33, which is a product of the same engineers. The new machine is powered with a 550-hp. Praga Model 2 S engine, but to date no performance figures are available.

Czech engine manufacturers

The War-time firm of Breitfeld and Danek (since become Ceskosko Moravska-Kolben-Danek) originally produced the 230 hp. Hiero engine but has lately purchased a license from the Isotta Fraschini Company (Italian) to build the 1,000-hp. Asso. They have also developed designs of their own, the 650/770-hp. Praga ESV, which is also available in a geared model, the ESVR.

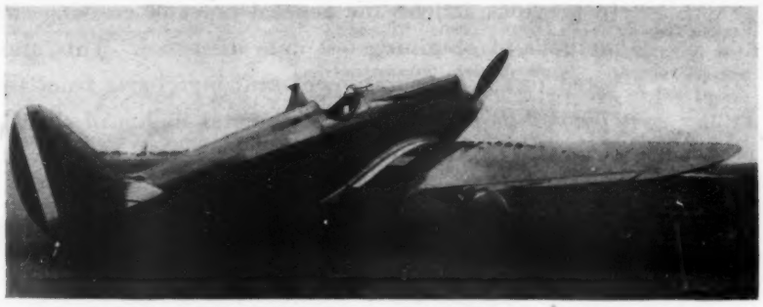
The firm of A. S. Walter began its career with a license to build the BMW IV, designed by Bayerische Motoren Werke of Munich. They later acquired a license to build Bristol Jupiters. Of special interest to American readers is the fact that Walter is the only European manufacturer, as far as is known, that was licensed to build the Packard Diesel engine. A series of radial air-cooled engines of Walter design has also been produced, ranging from the 70 hp. Polaris up to the 600 hp. Atlas. Walter engines are widely used not only in the Czechoslovakian air force, but also in Italy, Finland, Lithuania, etc. Walter holds license to build the Bristol Jupiters, Pegasus, Mercury, and the Gnome-Rhone Mistral.

Avia Aircraft Works maintains its own engine department, building under license, the Lorraine 450 hp. engine, the Hispano 300, 500 and 650 hp., and the Skoda Model L. Latest Avia engines are the Avia V 30, a supercharged twelve-cylinder power plant of 700 hp. at 2,400 r.p.m., weighing 1,126 lb., as a direct drive model, and 1,223 lb. geared. One of the largest engines is the Avia W 44, direct drive or geared eighteen-cylinder W type, supercharged by high speed centrifugal impeller (running at 16,800 to 24,000 r.p.m.) with a normal output of 1,000 hp. at 2,400 r.p.m. This engine weighs 1,500 lb., direct drive, and 1,646 lb. geared.

Czech air force organization

At the present time, the general staff of the Czechoslovakian air force consists of officers from the old Austrian air force, men from the Czechoslovakian Legion, and officers who got their training in France. New personnel is being drawn from current graduates of the Czechoslovakian Military Aeronautical Academy at Prostejov.

The air force proper comes under the jurisdiction of the Ministry for National Defence. It consists of six regiments each, composed of observation, reconnaissance, fighting and bombing squadrons, organized in wings. A research group is maintained at the Institute for Military Aeronautical Studies (Vlus) at Kbely. Equipment includes shops, laboratories, and a well-equipped airdrome for experimental flying.



Roumanian Pursuit,—the IAR single seater with 500 hp. Hispano engine.

The Kingdom of Yugoslavia

Yugoslavia's Adriatic boundary gives ample opportunity for naval as well as land type air service operations. Her air force, therefore, consists of both military and naval units, originally under a united command, but broken down in 1930 into two divisions, the military command at Novi Sad, near Beograd, and the naval command at Split (Spalato). The former consists of seven mixed regiments and the latter of two groups of three squadrons each.

Yugoslavia, basically an agricultural state, has developed but few designs of her own, and therefore relies heavily upon the purchase of aircraft abroad or upon the purchase of designs for local fabrication. Her planes and engines have been largely obtained from French, German and Czechoslovakian sources. Such machines as the Breguet 19, the Potez 25, the Dewoitine D 27 fighter and the Avia BH 33 have, of late years, been assembled and in part manufactured in Yugoslavia.

The principal factory is the Prva Srpska Fabrika Aeroplana Zivojin Rogozarski at Beograd, which originally turned out training planes of the old Brandenburg type, and later a light reconnaissance biplane with a 250 hp. Walter Castor engine. This machine is of conventional construction with steel tube fuselage and wooden wings. The Ikarus A.D. at Novi Sad and at Zemun produce not only the Potez 25 and the Avia BH 33 under license, but also an advance training plane of original design. A similar arrangement holds for Zmaj, Fabrika Aeroplana i Hidroplana at Zemun, which has turned out a number of French military types, as well as a light observation and advance training machine, notable for its use of the 230 hp. Wright Whirlwind engine. This last machine is the work of their engineer, Fizir.

The Kingdom of Roumania

A substantial coast line on the Black Sea gives Roumania also an opportunity to develop both military and naval aviation units. In this case, however, the entire air force is still under a single command. In its equipment, the French influence appears to be predominant, with a liberal sprinkling of English and Italian design.

Current reconnaissance and light bomber units are equipped with the Breguet XIX and the Potez 25. Fighter squadrons are equipped with Dewoitine and Leseurre single-seaters. The three flying boat squadrons are fitted up with Italian Savoia 59 flying boats, with 400 hp. Lorraine engines.

Aircraft manufacturing began in 1920, when the Astra rail car factories at Arad produced a two-seater biplane equipped with a 270 hp. Benz engine. Several years later, the IAR (Industria Aeronautica Romana) was founded in Brasov with the help of the French Societe Generale Aeronautique for the manufacture of the Potez 25, the Morane-Saulnier advanced training plane and the Lorraine engine of 450 hp. The chief designer of the IAR was Carafioli, graduate of the Ecole Superieure de l'Aeronautique de Paris. His latest design is a cantilever low-wing monoplane, a single-seat fighter equipped with a 500 hp. Hispano Suiza engine. This machine shows a top speed of 205 m.p.h., climbs to 16,400 ft. in seven minutes, 58 seconds, and has a service ceiling of 30,000 ft. It is of composite construction with wooden fuselage, duralumin wing spars, and wooden ribs. The fuselage is fabric covered. The wings have a plywood skin. Wood construction is favored because of the scarcity of skilled metal workers in Roumania.

SET (Fabrica di Avioane) at Bucharest was established in 1923 and has produced a series of two-seater advanced training machines (SET 7, 10, 31). It also turns out pursuit types. The single-seat fighter, SET XV, is of all metal construction. Fitted with a Gnome Rhone K9 engine it shows high performance. The SET XX with the Gnome Rhone K14 is expected to show a top speed of 236 m.p.h. at 13,000 ft. and will probably be ordered for re-equipment of fighter squadrons. A design for an advance training plane with a 365 Armstrong Siddeley Jaguar engine is now under consideration.

In previous articles the general types of cruising curves have been shown and methods of obtaining test data discussed. This, the sixth of the series, is devoted to the preparation of cruising charts from the test data with examples based on the experimental flights of the Douglas Transport.

Development of Cruising Charts

OPERATION AT DESIRED CRUISING CONDITIONS, PART SIX

By Edmund T. Allen and W. Bailey Oswald

THE CRUISING CHART presents a history of former flights of a given airplane in such a manner that the operation of controls for a desired performance can be determined for any future flight. It has been developed to present a ready picture of the airplane-engine combination throughout the range of operating altitudes and velocities. The degree of completeness, refinement, and accuracy will vary with the type of service for which the chart is intended, but the general character should be the same.

Since engine power and the related characteristics are the main variables, the determination of engine power in flights by engine power curve and propeller calibration methods has been treated in preceding articles (AVIATION, July, August, 1934). It was shown that the engine power can be obtained throughout the entire velocity-altitude region of flight from measurements taken during a series of level flights at various altitudes. During the cruising calibration flights, data are recorded including indicated velocity, atmospheric temperature, pressure altitude, carburetor air intake temperature, absolute intake manifold pressure and r.p.m., and certain other supplementary data. From these data we have deduced either directly or by calculation the following necessary relationships throughout the cruising region of velocities and altitudes:

1. Altitude (density and pressure).
2. True velocity.
3. Engine power (or per cent rated power).
4. R.p.m.
5. Absolute intake manifold pressure.

A convenient type of chart for obtaining the density altitude is plotted in Fig. 18. This conversion diagram is used later as the ordinate scale for the cruising charts.

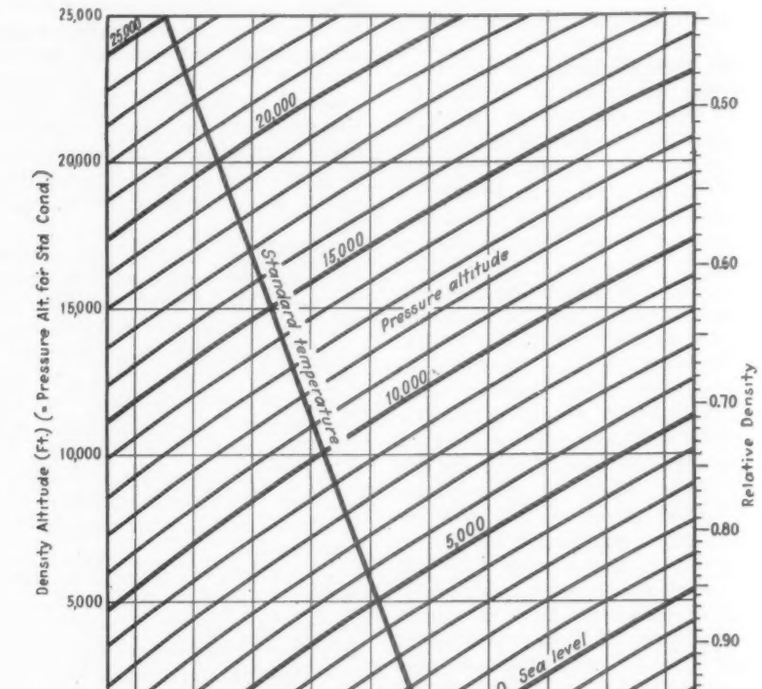


Fig. 18: Chart for converting pressure altitude and atmospheric temperature to density altitude or relative density.

It is impractical to plot observed points directly on the cruising chart and fair in curves from them, but it is strongly recommended that auxiliary curves of the various engine characteristics be plotted against velocity for each altitude at which data have been recorded. Fig. 19, 20 and 21 show such auxiliary curves for a typical test. In Fig. 19 are plotted the experimental points and faired curves for the engine power at various altitudes. Likewise in Fig. 20 and 21 are plotted the experimental curves for engine revolutions and intake manifold pressure respectively at the various altitudes.

Except in instances where test conditions are extremely favorable it will be found necessary to fair the curves making certain allowance for known general trends. The plotting of auxiliary curves is of special aid since the resulting curves are of generally well-known type, hence correct fairing is facilitated. One should note carefully

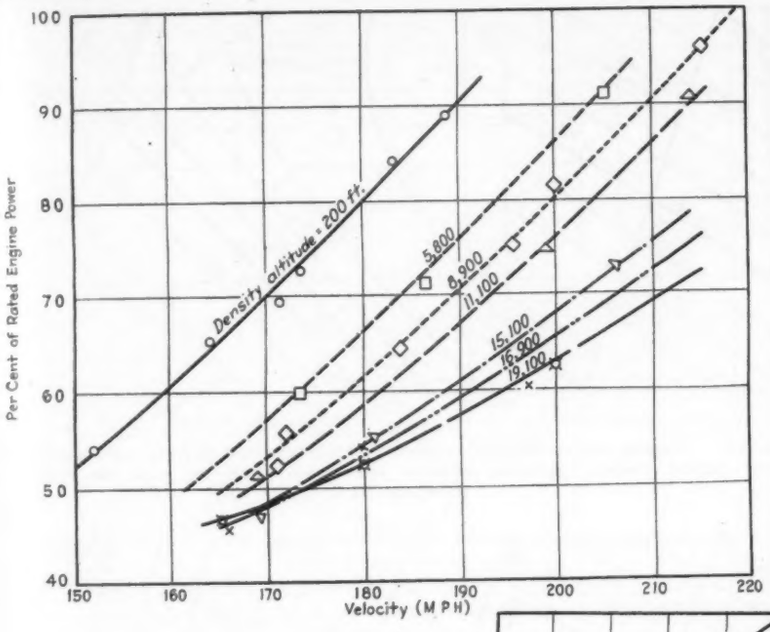
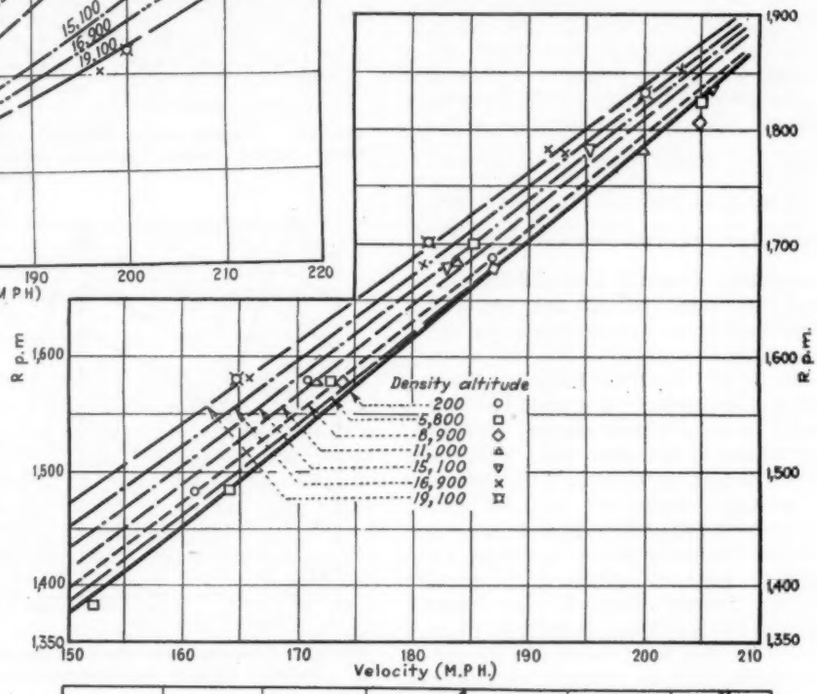
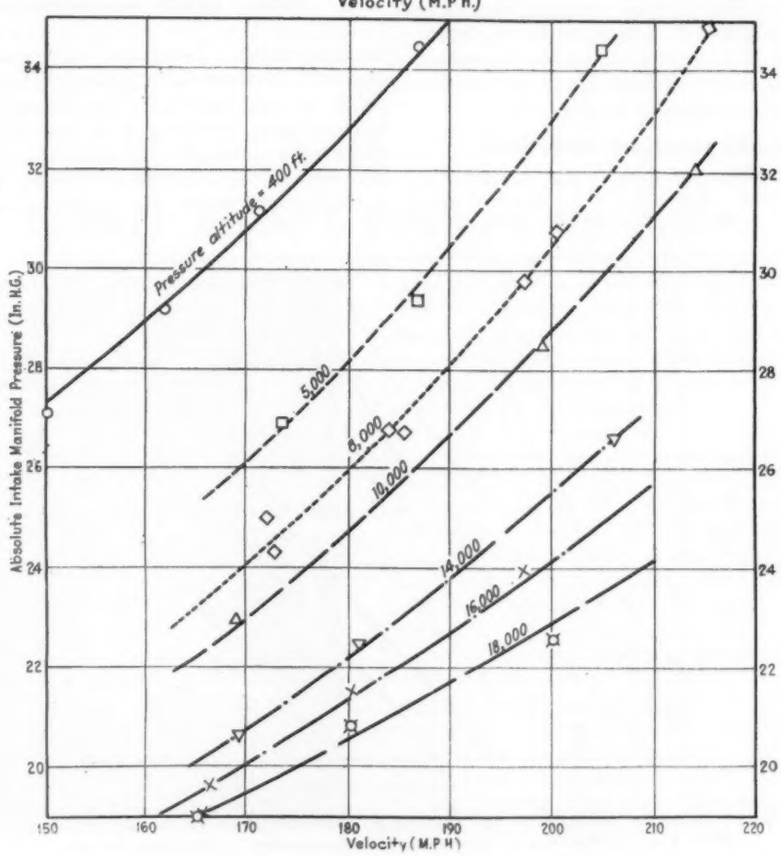


Fig. 19 (left): Per cent power versus velocity for various density altitudes. Experimental points were obtained during cruising flight test calibration of the Douglas DC-2 Transport

Fig. 20 (below): Engine revolutions vs. velocity for various density altitudes. (Douglas DC-2)

Fig. 21 (bottom): Absolute intake manifold pressure vs. velocity for various pressure altitudes. (Douglas DC-2)





any consistent variation and seek to explain or check in order to verify results. Careful use of the mixture control in flight and allowance for humidity effects on power and air density near sea level often assist in bringing stray points into line. It is nearly always possible to obtain a consistent set of curves from which the points obtained for use on the cruising chart are within the probable accuracy of operating the airplane.

Constructing cruising charts

It would be possible to use the auxiliary charts for cruising control, but their use would probably be confusing. Furthermore, the variation of true velocity with altitude for certain constant values of the engine characteristics is not clearly shown on them, nor does a simple combination of these curves seem possible. It has been found most desirable to construct the cruising chart on a background having a velocity abscissa and altitude ordinate. By plotting thereon lines for various constant values of the engine characteristics a chart is obtained that explicitly shows the cruising performance of the airplane throughout the entire altitude-velocity range of operation. Curves for velocity versus altitude for the various engine characteristics: power, revolutions and manifold pressure, are plotted in Fig. 23, 24 and 25. These curves are derived from the auxiliary curves in Fig. 19, 20, and 21 respectively.

It will be noted that the density altitude conversion chart of Fig. 18 forms the ordinate scale on the cruising curves showing velocity depending on engine power and r.p.m., while the curve showing velocity depending on manifold pressure uses simply the pressure altitude scale. The use of these particular scales permits immediate cor-

rection for temperature variations which must be made if any considerable accuracy is needed.

At constant velocity the power required to maintain the airplane in level flight remains fixed if the air density is unchanged. This relation of course follows from the fact that the attitude of the airplane is unchanged, hence drag and power remain the same. For constant velocity it follows that the engine r.p.m. in level flight are unchanged for constant air density. At constant power, velocity, and air density the r.p.m. would increase only if the power coefficient, Cp, of the propeller decreased in proportion to the cube of the increase in r.p.m. This is inconsistent as a decrease in advance ratio, $\frac{V}{nD}$, increases Cp, and vice versa. Propulsive efficiency also remains constant with $\frac{V}{nD}$ for the same density. The relations between the velocity and the required power and r.p.m. are therefore plotted against density altitude which corresponds to air density. Until a direct reading instrument is available the simplest way to obtain density altitude is by means of the conversion chart of Fig. 18 which is used as ordinate on the cruising charts.

In order to illustrate more strikingly the effect of temperature variation on cruising power and velocity at the same pressure altitude Fig. 22 has been plotted. In this figure individual lines are drawn for temperatures different from standard, thus showing explicitly the effect of temperature variation which is somewhat implicitly corrected for in the ordinate scale at density altitude conversion in Fig. 23.

Manifold pressure variations

Manifold pressure is not so directly connected with the air density and cruising speed. The actual variation of manifold pressure with temperature depends in each case upon the change of engine power resulting from the manifold pressure change. The manifold pressure however is a dependent variable and is determined when the engine power, r.p.m. and carburetor air intake temperature are known, as reference to engine power cuves will show. Since these factors are known for any point on the cruising chart, it is possible to obtain the manifold pressure for various temperature changes when it is assumed that carburetor air intake temperature is increased in the same amount as the air temperature. A check on the variation of manifold pressure with temperature for the cruising condition on several airplanes revealed that (within an error of about 1 per cent in velocity) the manifold pressure remains unchanged with pressure altitude. Thus at constant velocity the manifold pressure required to maintain the airplane in level flight is approximately independent of temperature. This assumption cannot be regarded as being universally applicable. In any case it is advisable to check a few points within the cruising region by assuming a temperature change and calculating for the same velocity the manifold pressure from the corresponding r.p.m., power, and carburetor air temperature.

In addition to the effect of air temperature variation for which correction has been provided on the cruising chart as previously explained, variations of certain other factors might modify the

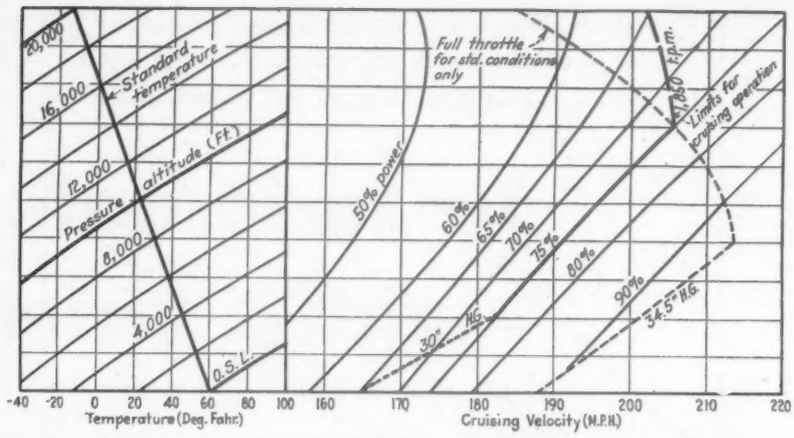


Fig. 23: Cruising chart showing velocity *vs.* altitude for various percentages of rated engine power. Density altitude conversion scale is used as ordinate. (Douglas DC-2)

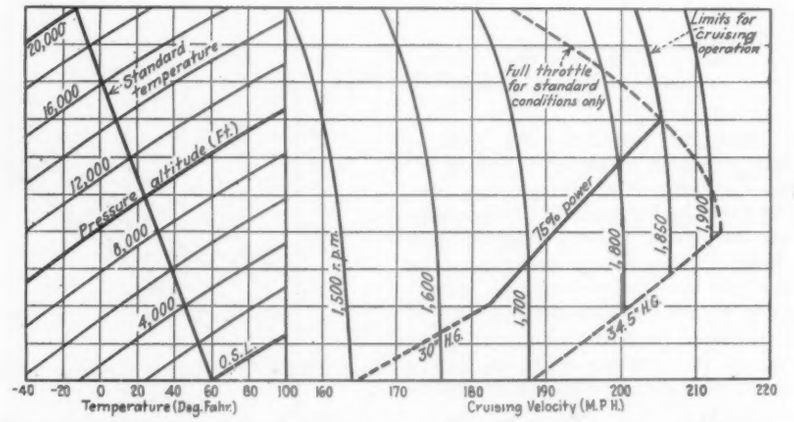


Fig. 24: Cruising chart showing velocity *vs.* altitude for various engine revolutions. Density altitude conversion scale is used as ordinate. (Douglas DC-2)

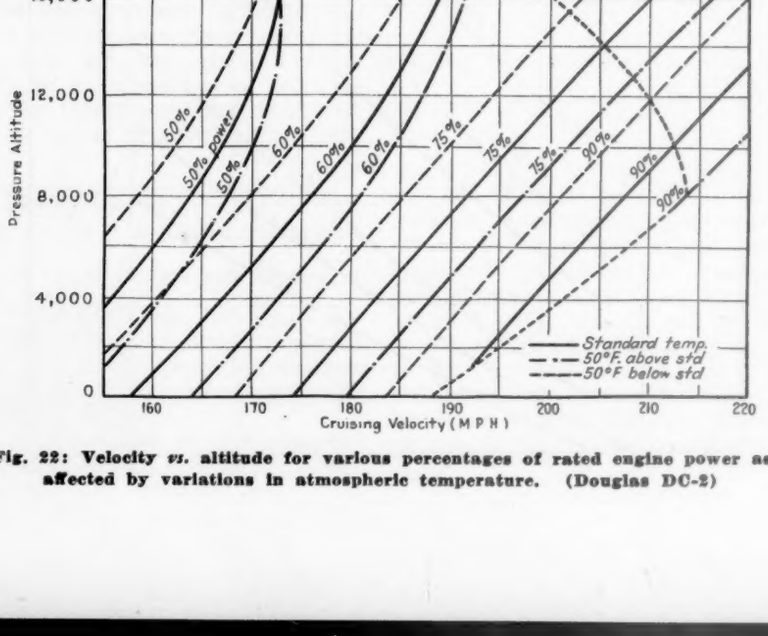


Fig. 22: Velocity *vs.* altitude for various percentages of rated engine power as affected by variations in atmospheric temperature. (Douglas DC-2)

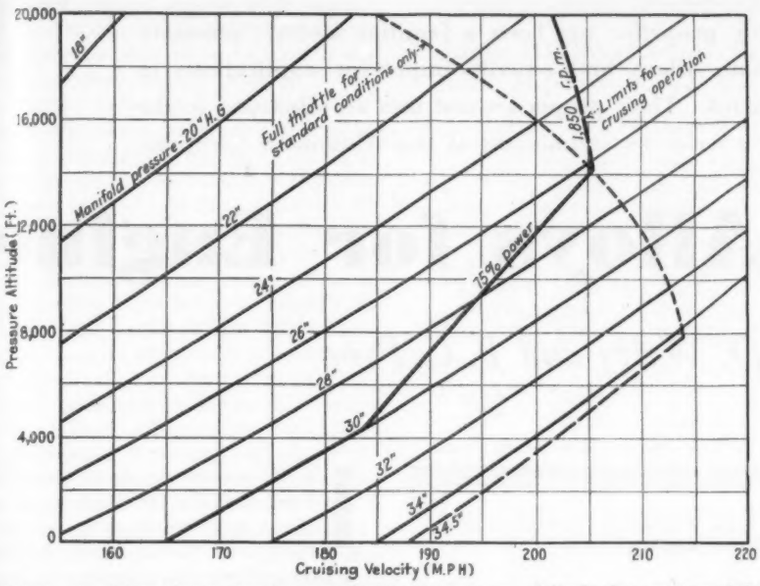


Fig. 25: Cruising chart showing manifold pressure *vs.* altitude for various intake manifold pressures. Simple pressure altitude scale is used for ordinate. (Douglas DC-2)

results. While a variation in carburetor air temperature from the usual increase above outside air temperature does not affect the engine power and r.p.m. against velocity, it does affect the full throttle limit and manifold pressure versus velocity. Thus the curves in Fig. 23 and 24 would be unchanged except for the maximum limiting curves, while the manifold pressure lines and limiting curves on Fig. 25 would be modified by changed carburetor intake air temperature. It can be generally assumed that the carburetor air temperature is close to its usual value, hence the charts are drawn up without correction. In case heaters are added or removed from the intake duct, or the temperature is modified in some other way, however, the limiting values and manifold pressure lines would of course, be shifted corrsepondingly to account for the resulting change in power.

Effect of load variation

A change in weight of the airplane modifies all of the cruising relations to a certain extent. The effect of a variation in weight becomes larger as altitude increases and velocity decreases, and is such that decreasing weight increases the velocity of flight for given engine characteristics. As weight decreases, the velocity increases for any given engine power, r.p.m., and manifold pressure. The cruising charts are usually developed for loadings of the airplane close to the gross weight, hence are somewhat conservative for lighter loadings. In cases where the airplane is intended to be used in flights at the lower speeds or higher altitudes with a change in weight greater than approximately 15 per cent of the normal gross weight it is recommended that cruising charts be developed for the light loading as well as the full gross weight. These charts for the light loading can either be obtained from flight test data reduction, and plotting as previously described, or through a series of modifications based on certain theoretical relations, which can hardly be treated in this discussion. Since guarantees are based on full gross load and performances are lowest for full load, it is generally satisfactory to use the full load chart. It is of course necessary in flight tests that the weight variation be small, for a consistent set of cruising curves cannot otherwise be obtained unless results are corrected.

Propeller setting

Any change in the propeller, such as pitch, diameter, and blade design, obviously will modify the curves. The largest change will probably occur in the velocity-altitude-r.p.m. curve and also in the manifold pressure curve. The engine power cruising curve of Fig. 23 would be little changed. Therefore, except for changes in propulsive efficiency which should be small for any probable modification, the charts can still be used provided that the revised propeller is adjusted so as to correspond to the r.p.m. cruising curves of Fig. 24. Power r.p.m., and manifold pressure should, then be approximately as obtained for the original propeller installation. It is essential that propeller characteristics be unchanged or, if modified, that they be carefully adjusted for obtaining satisfactory cruising operation.

The full throttle limit at altitude is shown only for standard conditions because of the more or less uncertain location of the limit due to probable variations of factors such as weight, carburetor air temperature, air temperature, mixture control, etc. This full throttle line is drawn in from test data making the somewhat questionable assumption that maximum velocity depends on pressure altitude only. No great accuracy is attempted because of these probable variations. By extending the power, r.p.m., and manifold pressure lines out beyond this limit it is possible to handle any situation that may be encountered with low carburetor air temperatures, high air temperatures, or any condition which would increase power or decrease density.

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Fokker XXXVI Sleeping Quarters

WHEN the Curtiss-Wright and American Airways designers were working out the details of the Condor sleeper plane they quite naturally evolved an arrangement of berths very much in the Pullman tradition. The berths of the Fokker XXXVI just as naturally resemble those in European Wagon-Lits. The Condor berths are heavily curtained. The Fokker ones are to be more open but will be segregated into compartments of four. In the American practice each two seats make up into two berths, in the Dutch the space occupied by four seats sleeps but two people, hence the capacity of the plane is halved when used as a sleeper. Of interest also are the use of steel aircraft tubing in framing the bunk structure and the level of the lower berth. In the Condor the lower berth is made up on the floor level. The FXXXVI will be used on the KLM route to Batavia.

The forged aluminum alloy propeller has been a familiar aircraft accessory for many years. Aluminum alloys find equally important applications in other parts of the power plant. Their properties and uses are discussed in the third, and last, article of a series by technicians of the Aluminum Company

Aluminum Alloys for Engines

By G. D. Welty and F. C. Pyne

IT IS something more than coincidence that the far-reaching advances of the past twenty years in the light alloy field should have paralleled a similar growth and progress in aeronautical science. The two have been to a considerable extent interdependent. Many of the remarkable achievements in aviation would have been impossible except for the availability of certain light alloys, methods of fabrication and heat-treatment. The discovery by Wilm in 1909 of the alloy "duralumin" which could be rolled, formed and heat-treated to possess properties of strength and ductility comparable to those of mild steel, made possible construction of the war-time Zeppelin ships. Today, these alloys are the backbone of all rigid airship construction. Similarly, the mod-

Table I: Approximate Alloy Compositions

Alloy	Copper	Iron	Silicon	Zinc	Magnesium	Manganese	Nickel	Aluminum (Minimum)
				CASTING				
109	12.0	...	...	...	...	...	...	85.5
112	7.5	1.2	...	1.75	...	...	...	87.5
122	10.0	1.2	...	...	0.25	...	...	87.0
142(Y)	4.0	...	...	...	1.5	...	2.0	90.0
355	1.2	...	5.0	...	0.5	...	...	92.0
A-355	1.4	...	5.0	...	0.5	0.75	.75	89.5
195	4.5	...	...	...	...	...	...	93.0
				FORGING				
17-S	4.0	...	...	...	0.5	0.5	...	92.0
18-S	4.0	...	...	...	0.5	...	2.0	91.0
25-S	4.5	...	0.8	...	...	0.8	...	92.0
32-S	0.8	...	12.0	...	1.0	...	0.8	82.0
51-S	...	...	1.0	...	0.6	...	...	96.5

Table II: Typical Mechanical Properties of Sand Casting and Forging Alloys at Room Temperature

	Tension			Compression†			Hardness			Shear		Impact	Fatigue	
Alloy	Ultimate Strength lb./sq.in.	Yield Strength lb./sq.in.	Yield Strength Tensile Strength Ratio	Elongation per cent in 2 in.	Ultimate Strength lb./sq.in.	Yield Strength lb./sq.in.	Brinell	Shore	Rockwell	Shearing Strength lb./sq.in.	Shearing Strength Tensile Strength Ratio	Izod foot-pounds	Endurance Limit lb./sq.in.	Endurance Limit Tensile Strength Ratio
						CASTING								
109	24,000	18,000	0.75	1.5	45,000	23,000	75	24	E-82	20,000	0.83	0.32	10,000	0.42
112	22,000	14,000	0.64	2.0	44,000	24,000	70	23	E-79	20,000	0.91	0.35	8,500	0.39
122	25,000	21,000	0.81	0.5	54,000	33,500	90	28	E-90	25,500	0.98	0.28	9,500	0.37
142(Y)	28,000	24,000	0.86	1.0	52,000	34,000	85	26	E-88	24,000	0.86	0.35	9,000	0.33
*195-T4	31,000	16,000	0.52	8.0	43,000	27,000	65	21	E-75	27,000	0.87	2.10	6,000	0.19
*195-T6	36,000	22,000	0.61	4.0	43,000	28,000	85	26	E-88	29,000	0.80	1.85	6,000	0.17
*195-T62	40,000	27,000	0.68	2.0	56,000	45,500	95	30	E-92	30,000	0.75	0.83	7,000	0.18
*355-T4	30,000	20,000	0.68	5.0	65,000	25,000	70	23	E-79	30,000	0.97	1.33	.....	....
*355-T6	35,000	27,000	0.73	3.0	68,000	29,000	85	26	E-88	30,000	0.81	0.93	.....	....
*A-355-T51	28,000	24,000	0.86	1.5	.....	.....	60	..	E-70	21,000	0.75	0.35	.....	....
						FORGING								
*17ST	58,000	35,000	0.60	20.0	.....	35,000	100	30	E-96	35,000	0.60	9.5	15,000	0.26
*18ST	55,000	35,000	0.64	10.0	.....	35,000	100	..	....	.....	....	.....	.....	....
*25ST	58,000	35,000	0.60	18.0	.....	35,000	100	30	E-96	35,000	0.60	7.5	15,000	0.26
*32ST	53,000	43,000	0.81	7.0	.....	43,000	120	..	....	.....	....	....	14,000	0.26
*51ST	48,000	38,000	0.79	14.0	.....	38,000	95	28	E-92	30,000	0.62	2.0	10,500	0.22

*Indicates heat treatment. †L/R ratio of specimens 16-20. All failed by lateral bending.

ern aircraft engine, with its high power-weight ratio, depends largely upon alloys which may be said to have grown up with the aircraft engine industry.

It cannot be denied, on the other hand, that aviation has been responsible for much important progress in the light alloy field. It has stimulated an intensive study of many of the properties of different alloys which would otherwise have remained unattempted. It is difficult to conceive a field where a more comprehensive knowledge of metals is required than in the design and manufacture of aircraft power plants and structures. Extreme conditions of temperature encountered in certain parts require accurate information concerning the properties and behavior of materials used for these parts within the temperature range involved. Resistance to the corrosive influence of "doped" fuels inside the engine and to moist salt atmospheres without is highly important in many types of service. High thermal conductivity and low coefficient of thermal expansion are essential, particularly in the case of alloys designated for use in pistons and in air-cooled cylinder heads; while low specific gravity must not be lost sight of in pieces having any substantial bulk. In addition to these characteristics, the material should lend itself readily to fabrication in the forms desired and should possess acceptable machining properties.

Search for balance

No single alloy will possess to the optimum all of the properties desired for a given application. It is always a matter of compromise, i.e., the material having the best balance of properties should be selected for the use intended. In order to make such a selection intelligently, accurate information covering a variety of alloys is essential and some of the more important data pertaining to the properties of various aluminum casting and forging alloys are tabulated in the accompanying tables.

Like the vast majority of other metals, the aluminum alloys show a decrease in ultimate strength, yield strength and hardness with increasing temperatures, such changes being accompanied by increasing ductility. Not only do these properties vary with temperature but with time of exposure as well. It is consequently insufficient simply to heat a sample to a certain specified temperature and then test immediately. A series of samples must be run at each temperature and tested at that temperature after varying lengths of time, so that the course of the change may be followed until the alloy approaches its equilibrium properties, that is, the limits to which it will ultimately reach if run indefinitely in an engine at that particular temperature. At the higher temperatures, the bulk of this change will occur within ten days; while at the lower temperatures, where the rate of change is comparatively small, equilibrium is not reached in some cases even after six months of continuous exposure.

Table III: Mechanical Properties of Casting and Forging Alloys After Exposure to 400 and 600 Deg. F. for Approximately 75 Days

	400 Degrees Fahrenheit				600 Degrees Fahrenheit			
Alloy	Ultimate Strength (lb./sq.in.)	Yield Strength (lb./sq.in.)	Elongation per cent (in 2 in.)	Brinell Hardness	Ultimate Strength (lb./sq.in.)	Yield Strength (lb./sq.in.)	Elongation per cent (in 2 in.)	Brinell Hardness
CASTING								
122	20,600	14,400	1.00	73	8,000	4,200	14.5	51
142 (Y)	23,700	17,600	2.00	76	7,500	3,150	14.0	48
355-T4	20,000	17,500	2.00	60	5,700	2,800	21.0	42
A-355-T51	17,000	11,700	3.00	63	8,400	5,400	8.0	46
FORGING								
18-ST	16,400	.....	53.70	48	5,550	....	71.0	37
32-ST	17,000	12,500	20.00	60	5,600	3,000	44.0	43

Note: Brinell Hardness tests made at room temperature after specimens were tested at elevated temperatures.

Table III gives the mechanical properties of three casting alloys and two forging alloys after exposure at 400 deg. F. and 600 deg. F. for approximately 75 days. The casting group includes the three alloys in general use in the United States for cylinder heads, while the two forging alloys are used in practically all aircraft pistons.

In Table IV are given the specific gravity, thermal conductivity and coefficient of thermal expansion of the various alloys under discussion. Specific gravity is of importance in all bulky parts. The specific gravity of the various alloys differs by as much as 10 per cent and this in a large engine can easily result in a weight saving or penalty of as much as 25 or 30 lb., depending upon the alloy employed. Thermal conductivity and the coefficient of thermal expansion relate most directly to pistons and to air-cooled cylinder heads. Low thermal expansion in pistons means reduced operating clearance, while high thermal conductivity is required for proper functioning in both pistons and cylinder heads.

Need for further tests

While Tables I to IV inclusive give some of the properties of the light alloys which may serve as a guide to the engine designer in his selection of materials, there is much other information which is highly desirable but not yet available. For example, extensive tests are now being devised to secure additional data on resistance to fatigue or repeated stress, particularly at elevated temperatures.

One of the outstanding developments in the aircraft field has been the radial type engine. Paralleling this development has been the development of suitable materials and fabricating methods for such parts of these power plants as crankcases, link rods, super-chargers, nose pieces, bearing caps, generator and starter parts, impellers, etc. The aluminum alloy crankcases present one of the typical and most interesting developments.

Heat-treated aluminum alloy sand castings provided the first light weight radial engine crankcase. Such castings possessed the essential mechanical properties for the earlier low power engines. As engines of increasingly higher power were conceived to meet the requirements of high speed passenger, mail and military planes, it soon became recognized that a material possessing a higher strength-weight ratio was needed. A material was also desired which would

Table IV: Specific Gravity, Thermal Conductivity, and Coefficient of Thermal Expansion of Sand Casting and Forging Alloys

		Thermal Conductivity		Coefficient of Thermal Expansion
Alloy	Specific Gravity	cal/cm²/C° 20°C.	200°C.	Per C° (20C.-100°C.)
CASTING				
109	2.94	...	...	.000022
112	2.86	...	...	.000022
122	2.92	.34	.38	.000022
142	2.82	.34	.38	.000022
195-T4	2.80	.35	.40	.000023
355-T4	2.68	.36	.43	.000022
A-355-T51	2.69	...	...	.000022
FORGING				
17-S	2.79	.35	.41	.000023
18-S	2.82	...	...	.000022
25-S	2.79	.37	.43	.000023
32-S	2.67	.40	.40	.000018
51-S	2.68	.45	.48	.000025

provide structural uniformity in excess of that provided by castings.

It was soon realized that heat-treated wrought aluminum alloys were necessary to solve this problem and provide the required high strength, homogeneous metal structure, and dependable ruggedness and light weight. Hot forging provided a means of fabricating such a product but it was only after considerable development that this process could satisfactorily be applied to such an intricate part as the crankcase. Today, by far the majority of radial engine crankcases, particularly for high powered engines, are made of strong aluminum alloy forgings. The production of such forgings requires considerable skill in fabrication, rigid technical control, and specially developed equipment to obtain the uniform high strength and low specific gravity demanded by designers.

Crankcases and pistons

Crankcases for radial engines having a single bank of cylinders are made in two pieces, a front section and a rear section, machined separately and bolted together to form the crankcase unit. A forged aluminum alloy nose piece is also used in the construction of the larger engines. The more recent twin row radial engines utilize four forged aluminum sections in the crankcase assembly; nose piece, front section, center section and rear section. These are machined separately and bolted together.

Pistons are another excellent example of how aluminum alloy forgings have filled the demand for greater uniformity in aircraft engine parts. With increasing engine power, pistons are subject to increasingly severe operating conditions and therefore demand the use of materials with maximum uniformity and quality. Through the use of a forged piston the aircraft engine manufacturers have practically eliminated their machining scrap and removed all question of internal defects which might lead to failures in service.

The use of 32S alloy for pistons, with its comparatively low coefficient of thermal expansion, has overcome one of the principal objections to aluminum alloy pistons. Pistons of 32S-T alloy permit less clearance between piston and cylinder walls than was formerly possible.

Crankcase forging for a nine-cylinder radial engine.

The low specific gravity of 32S-T alloy gives it added advantages over other aircraft piston alloys in the reduction of inertia loads and counterbalanced weight, and the subsequent reduction of stresses. The alloy also possesses good thermal conductivity and excellent resistance to abrasion, both factors contributing to its present recognition as an outstanding aircraft piston material. The thermal efficiency of a forged piston may be increased quite materially by the use of ribbed and waffle type heads, a construction found otherwise desirable for aircraft pistons.

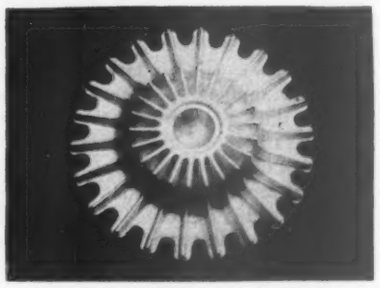
Cast cylinder heads

The problem of devising a suitable alloy possessing the required casting characteristics, pressure tightness, mechanical properties and corrosion resistance has long confronted the manufacturer of aircraft engine cylinder heads. A number of alloys with satisfactory mechanical properties have been available, but none possessed the desired castability until 355 alloy was developed primarily for this purpose. Containing silicon as the principal alloying constituent, this alloy has desirable casting characteristics for castings required to be pressure tight. Controlled additions of copper, iron and magnesium provide the necessary hardening elements, and the desirable mechanical properties are developed by heat-treatment. This alloy also possesses the low specfic gravity and excellent corrosion resistance characteristic of aluminum-silicon alloys. Castings take an excellent anodic coating, which although rather gray in color, provides additional corrosion resistance and improved resistance to abrasion.

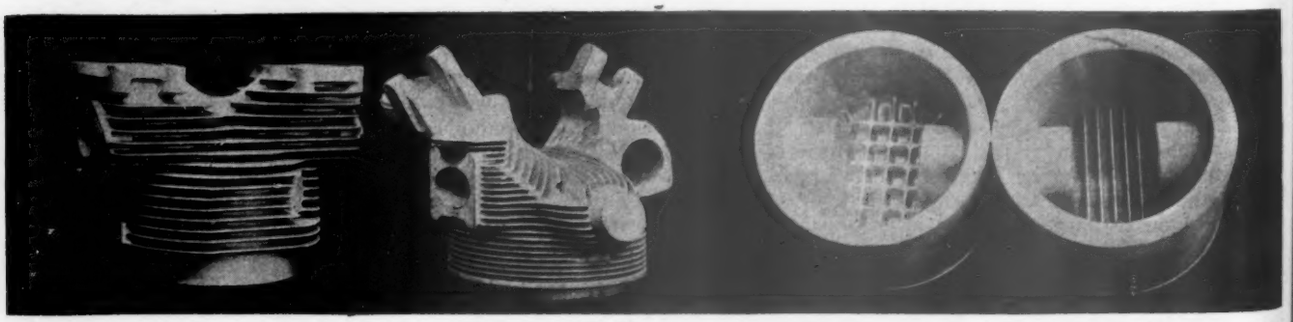
A number of heat-treatments are provided to produce a variety of mechanical properties suitable for a great number of engineering applications. For maximum ductility, heat-treatment followed by a quench is necessary. A subsequent precipitation treatment (aging) can be used to increase the hardness and tensile strength with some reduction in ductility. Alloy 355 is also subject to certain improvements in mechanical properties through a precipitation treatment alone. Such treatments are preferred for applications involving operating temperatures above the annealing temperature of the material and where initial properties developed by heat-treatment are soon lost. By adjusting the time and temperature of the precipitation treatment it is also possible to remove any appreciable tendency toward permanent growth and still retain desirable properties.

The mechanical properties of 355 alloy at elevated temperatures have been found quite satisfactory for castings operating up to approximately 400 deg. F. Such parts as liquid-cooled cylinder heads designed on the basis of the elevated temperature properties, are now extensively made in 355 alloy.

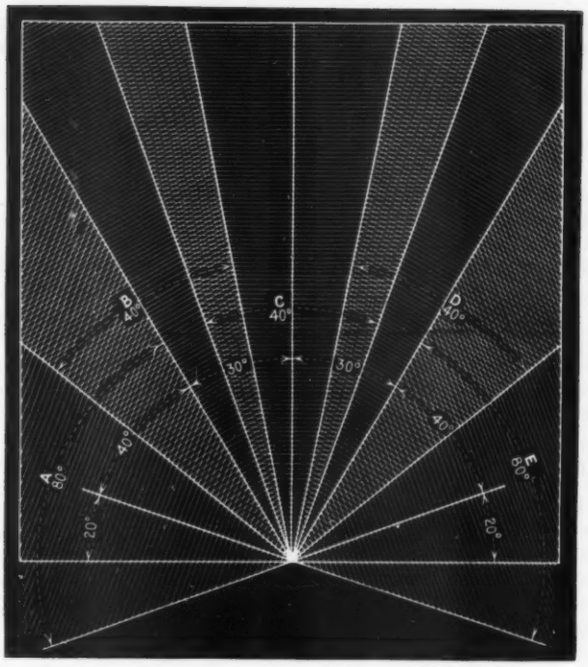
A modification of this alloy known as A-355, containing controlled additions of manganese and nickel, provides more desirable properties at temperatures from 400 deg. F. to 600 deg. F. This latter alloy is designed for such parts as air-cooled cylinder heads whose operating temperatures fall in this latter range.



Forged supercharger impeller blank.



Left: Two air-cooled cylinder heads illustrating advance in foundry practice during past several years. Note particularly close spacing of fins on right hand head adds greatly to cooling efficiency. Right: Forged pistons showing two different styles of cooling ribs on inside of heads.



Scheme for lighting 2,500 ft. square field from a single point. Five CAG-25 projectors are used with beams overlapping as shown. A duplicate installation on a separate electrical circuit at a point directly opposite would eliminate any need for ever landing toward the light source.

Floodlighting the Airport

By
R. W. Cost

Commercial Engineering Department
Westinghouse Lamp Company

WITH some 40 per cent of all commercial flying done at night and increasing passenger demand for schedules that do not interfere with business hours, the importance of artificial lighting at airports continues to grow. Of approximately 1,200 municipal and commercial airports now in active service, about 350 are partially or completely lighted. With the continued up-trend in air transportation of passengers, mail and express, it is estimated that at least 2,000 airports will be necessary for proper coverage in the near future.

While a number of types of lighting are required for safe performance of night landing operations, the design of the floodlighting system for the landing area should be given especially careful study. Light distribution must be as even as possible and there should be no abrupt changes in intensity. Where the terrain is not level the floodlight projectors should be placed so as to illuminate the entire ground as evenly as possible. Direct glare from the floodlights must be reduced to a minimum because of the danger of temporarily blinding the pilot if he lands toward the light sources. They should therefore be so controlled as to eliminate as far as possible all upward light rays outside of the main beams.

The Bureau of Air Commerce, U. S. Department of Commerce, recommends that "there shall be a sufficient intensity of illumination to reveal the details of the surface and make depth perception readily possible from an altitude of at least 30 ft. in the center of the lighted area. The minimum intensity of illumination over the usable portion of the landing area should be not less than 0.15 footcandle measured at each point on the vertical plane of maximum illumination."

Floodlight locations

There are two general methods used in airport floodlighting, the centralized system, and the distributed system. In the former, one large floodlight (or a group of smaller ones) is placed at a single location near the field boundary. In the latter system the floodlighting units are usually located in one of several different arrangements to suit the type of landing area. They may be grouped in banks on two or more sides of an all-way landing field, arranged in banks at the extremities of runways, or spaced at definite intervals along field boundaries or runways.

If a single large projector or a bank of smaller units is employed, its location is generally governed by the prevailing wind direction so that the number of landings directly toward the light sources may be minimized. The necessity for landings of this type can be eliminated entirely by locating banks of projectors on two or more sides of an all-way landing area and operating them on separate circuits.

Mounting height has been limited in the past because of the potential hazard of projector banks along the landing area. The present tendency is toward a height of 12 to 25 ft., whereas, formerly the elevation did not usually exceed 10 ft.

Higher mounting results in a more even ground illumination with less upward stray light which might otherwise interfere with the vision of the pilot. Frequently a bank of projectors can be installed in front of a hangar or some other structure without creating an additional obstruction.

Incandescent projectors with silvered glass precision reflector, spread lens, and louvers or other devices to prevent stray light above the beam, are widely used for both the centralized and distributed systems. The parabolic glass reflector with a long focal length, when used with a light source of comparatively small dimensions, produces a beam of light with narrow vertical and horizontal divergences. A spread lens on the front door will increase the divergence horizontally without increasing it vertically. Clear lenses or rectilinear spread lenses from 20 deg. to 100 deg. spread are variously employed, depending upon the length and breadth of the area to be floodlighted. When the projector is mounted on a rotatable bow, accurate positioning of the beam on the landing area is facilitated.

Incandescent lamps

The 3,000-watt and 1,500-watt, 32-volt, Mazda lamps were originally developed for the 25-in. projector, the low voltage design permitting the use of heavy filament wire and maximum concentration of light source with a mini-

mum vertical dimension. As these lamps are operated base down, bottom guides on the filament are omitted, enhancing sharp cut-off on the upper side of the projected light beam. The lamps require in excess of 50 amperes and are equipped with a two-prong or "bi-post" base which provides a maximum of socket contact. A small quantity of powdered tungsten is placed inside of each lamp before sealing. Shaking the lamps occasionally scrubs off any accumulated tungsten deposit on the inner glass surface. These lamps have a rated average life of 100 hours which represents about one year's service at present operating schedules on the average airport.

Floodlight intensities

In computing the number of floodlight units required to illuminate a landing area at a pre-determined footcandle intensity, it is necessary to have complete light distribution data on the selected projector with various combinations of spread lenses and lamps. The light distribution curve of the Westinghouse CAG-25 projector with 40-deg. spread lens and 3,000-watt, 32-volt lamp shows an effective candlepower of 1,000,000 in a zone of 10 deg. to the right and 10 deg. to the left of the beam axis, or a total of 20 deg. The footcandle illumination on a vertical surface at the opposite side of the field can be computed as follows:

$$\text{Footcandles} = \frac{\text{Candlepower of source in that direction}}{(\text{Distance from source in feet})^2}$$

$$= \frac{1{,}000{,}000}{2{,}500 \times 2{,}500}$$

$$= 0.15$$

Thus it is seen that the projector described above will provide approximately 0.15 footcandle at a distance of 2,500 ft., effective over a spread of about 20 deg.

Let us assume that it is desired to floodlight at the minimum recommended value of 0.15 footcandle, a fairly level all-way landing field approximately 2,500 ft. square with its sides facing north, east, south and west, and westerly prevailing winds. For safety it has been decided to use the distributed system with a bank of projectors on each of two opposite sides of the field. As most landings would be made from east to west, one bank of projectors should be located at the middle of the eastern boundary and arranged to produce a fan of light over the entire area or 180 deg. spread. Using three CAG-25 projectors with 3,000-watt lamps and 40-deg. spread lenses, with overlapping adjacent beams at a point 15 deg. from their axes, a net light spread of 90 deg. is obtained, every point of which has an intensity of at least 1,000,000 cp.

The remaining 45-deg. areas of the field to the right and left of the 90 deg. sector require light projection for an average distance of not over 1,300 ft. A lower average candlepower will suffice therefore to provide the desired minimum intensity. An examination of the projector's light distribution curve with a 3,000-watt lamp and 80 deg. spread lens reveals that one of these units will adequately illuminate each 45 deg. area to the desired intensity.

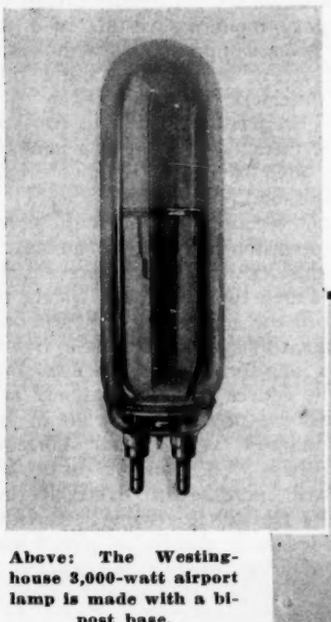
From the above analysis it is evident that a bank of five CAG-25 projectors with 3,000-watt, 32-volt lamps, three units equipped with 40 deg. lens and two with 80 deg. lens will meet the minimum requirements. A similar bank of projectors on the opposite side of the airport, operating on a separate circuit, will provide a like distribution of light and eliminate the necessity of ever landing toward the light sources.

Lighting the runway

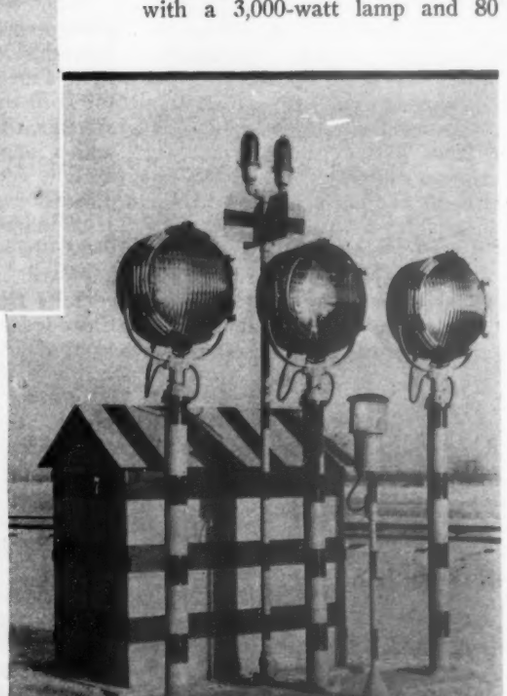
To illuminate individual runways it is desirable to locate floodlight units at each end. Assume that it is desired to floodligh a runway 500 ft. wide and 2,600 ft. in length to a minimum intensity of 0.20 footcandle at the extreme end. The CAG-25 projector with 25 deg. rectilinear spread lens and 3,000-watt, 32-volt lamp has an effective candlepower of approximately 1,400,000 in the 10 deg. lateral zone at the center of the beam, which will provide about 0.21 footcandle at 2,600 ft. This projector should be located at the right hand side of the approach and pointed in such a manner that the zone of highest beam intensity is centered near the remote end of the runway. To illuminate the less distant area on the left side of the runway, a CAG-25 projector with 80 deg. rectilinear spread lens and 1,500-watt, 32-volt lamp, mounted beside the other projector, will provide an average intensity of 0.5 footcandle. The beam of this projector should be centered on the area, overlapping the other beam approximately 15 deg. Experience indicates that it is desirable to provide good lighting at the runway approach with the intensity tapering off toward the opposite end. Two similar projectors located on the right hand side of the approach at the opposite end will facilitate two-way landing.

Circuits and control

The floodlight system should be controlled at some convenient point such as the traffic control observatory. Current for the floodlight banks is derived from one or more distribution transformers having usually a 2,300 volt primary and 32 volt secondary. Where individual floodlight units are distributed around the landing area, the lamps are generally operated on an isolating current transformer having 6.6 ampere primary and 32 volt secondary. The 6.6 ampere circuit in underground cable is controlled by a constant current regulator. Electrically operated remote control oil switches and relays provide an economical means of control for series or multiple circuits. The switches are solenoid operated from pilot circuits which may be centralized on an operating board designed for this purpose.



Above: The Westinghouse 3,000-watt airport lamp is made with a bi-post base.



Right: End-of-runway installation at Shushan Airport, a typical assembly of flood-lighting units (Westinghouse).

EDITORIALS

AVIATION

A Show for 1935?

WITHIN a few days the 1934 National Air Races will have passed into history. In bygone years it was the fashion to begin to plan for the next year's aircraft show as soon as complete recovery had been made from the effects of the races, but two years have elapsed since there was an exposition of national proportions and the third is well advanced. Less than two years ago AVIATION went on record as opposed to any form of annual show until the non-military production figures passed the 5,000 unit mark. At that time a biennial policy had been discussed, but that apparently was forgotten in the discouragement of last year's production.

The 1932 Detroit Show closed its doors in an atmosphere of gloom. Sales had been made during the show period, but they did not compare in volume to those of previous years. Even though they were real sales and not the accumulated purchase contracts of the first quarter, with signatures deferred for the publicity value of execution during show week, the conclusion was reached that shows were luxuries that could be eliminated in depressions. Perhaps this is the case. It is most certainly true when military services and air transport operators represent the bulk of the purchasing power. But there is a still small indication that the general public is or is about to be in the market for airplanes.

Manufacturers who build mainly for the private owner field have found recent encouragement in the increasing demand for pleasure craft. There have been substantial rumors of unfilled orders and plants working overtime. There has been concrete evidence of an upturn in the semi-annual production figures. Several oldtimers among the small plane manufacturers have emerged from apparent hibernation to present designs that indicate that they have not been asleep but have been keeping pace with all modern airplane developments. The Bureau of Air Commerce is striving valiantly to create a New Deal for the private pilot by judicious relaxation of regulation and encouragement of the design of easily-operated airplanes for the novice. Surely exhibitors would not have to resort to ornamental fences to provide originality for their offerings in a show in 1935 as they did in 1932. They would have something new in airplanes to display. Engine, accessory, and material manufacturers would also have three years of progress to report.

A number of problems present themselves in planning for a show. There never has been complete agreement as to time or place. Some exhibitors feel that April is too late to introduce spring models, others contend that the first quarter is too early to conduct effective demonstration flights and initiate concentrated sales effort. The combination of centralized location and adequate accommodation is a difficult one to fulfill. Fortunately the managerial talent of past successful exhibits remains within the industry.

Second to none in importance is the matter of cost and the problem of finding ways and means of holding the expense within the confines of 1935 purses and this clearly calls for the introduction of incidental attractions, such as pleasure flight promotion. Even in 1932 the International Model Air Line was reasonably successful and this year has seen a substantial revival in the joy hopping business. Given a continued increase in national income, 1935 should be even more promising for the short flight prospects. This is but one of the additional attractions that might be harnessed to make a show help pay for itself.

Now is the time for the industry to give serious consideration to the question of a show in 1935. If it is found to be desirable there is little enough time left in which to make the necessary arrangements. Each manufacturer should weigh the question carefully, in terms of the recent increases and probable future improvement in his business, and render his decision to the Aeronautical Chamber of Commerce. Its cooperation can be counted on if an affirmative decision appears to be in the best interests of the industry as a whole.

Washington Concordat

SELDOM does a group assembled from the four corners of the United States meet with the government agency delegated to police it with such singleness of purpose, and in such an obviously cooperative mood, as did airline officials and the Bureau of Air Commerce at Washington in mid-August. There were some differences of opinion, of course, but with few exceptions, they concerned details of phraseology rather than underlying principles. Through the whole performance ran one common thought, SAFETY—the safety of every citizen who uses the air lines for personal transportation.

A few months ago we talked about horseshoe nails,

meaning, of course, those little things which, by turning up missing at the psychological moment, may turn a well organized plan of attack into a complete rout. In revising Bulletin 7-E it was clearly everyone's idea to sort out and to classify every possible size and shape of horseshoe nail, and to put it into its proper bin, plainly labeled, so that there could be no fumbling at crucial moments.

In the last eighteen months things have been happening in air transport, happening so rapidly that the code of regulations set up four years ago had long since become obsolete. High-speed, multi-motored equipment had introduced problems beyond the scope of the old rules. An unfortunate series of accidents in recent months had raised embarrassing questions in the public mind. It was clearly high time that something be done to restore confidence before it had become dangerously shaken. Nothing could have been more appropriate than a general meeting to discuss openly matters of vital importance to all concerned. Even if the agendum was beyond the technical comprehension of the public, the mere fact that meetings were held, and new regulations drafted, should have a salutary effect.

Within a few weeks the complete final draft of the revisions will be available. In the meantime, the news pages of this issue carry brief mention of the high spots. Looking at them as a whole, one thing is plain. The day of schedule control by the individual pilot in the air is over. More and more the responsibility for deciding when, where, and how to fly a given route is being concentrated in the hands of thoroughly trained and competent ground personnel.

To the Aeronautical Chamber of Commerce, and to the operators who came to Washington to lay their cards face up on the table, our congratulations. To the Department of Commerce—great credit for a thoroughgoing analysis of conditions, and a sympathetic and reasonable understanding of the problems of the individual. To Major Schroeder, an orchid for his competent handling of a potentially difficult session.

A Matter of Records

ANYONE who has permitted his judgment to be warped by the tumult and the shouting of the spring of 1934 will find it necessary to make drastic revision in his ideas as to the status of American aeronautical equipment and methods if he will take the trouble to make even the most casual inspection of the current world picture. Military markets aside (where American manufacturers are making notable headway against long entrenched European competition), the patriotic citizen may point with pride to an ever increasing popularity of American-built planes, engines and equipment on foreign airlines.

American planes on routine schedules go roaring down to Rio, hurdle Swiss Alps, thread the rivers of China, and presently will be seen on the routes to India and the South Seas. Black men in loin cloths, bronze men in sarongs, yellow men in quilted coats and furs daily hear the roaring of Cyclones, the song of Wasps and Hornets. American propellers cut bright disks in crisp arctic skies, shimmer under torrid tropic suns. On many an instrument board, dials bearing U.S. trademarks point unerringly to destinations under far horizons.

The eyes of the world are turning to America not only for equipment, but also for guidance in operating technique. The last six or eight months have seen a great influx of foreign visitors,—pilots, operations managers, engineers and directors,—to make first hand observation of American airlines. Communications systems, weather stations, airports, repair shops have been the objects of intensive study. More than one expert in some specialized field has been offered (and accepted) employment abroad. Maintenance men, instructors in blind flight procedure, and others of the same category are now engaged in showing the rest of the world how things are done over here.

Facts of this sort constitute the real "record of progress" abroad, but because they require some intimate knowledge of the industry to be fully appreciated, they frequently escape the notice of the layman. For one reason or another, the suspicion still lingers in many an American mind that things are somehow done differently over there. One still meets people who feel that it is one thing to book passage from Croydon or Le Bourget, but quite another to enplane at Newark or Grand Central. They are right, there is a difference,—but unfortunately they are putting their money on the wrong horse.

In such cases statistics do not help much. Talk of subsidies, ton-miles or passenger-miles engenders but mild surprise, or downright scepticism. There is one thing, however, that the average American can understand, and that is an established record of some sort. In aviation, as in yacht racing, hog calling or marathon dancing, one good resounding world's record is worth a bale of statistics. When, as was pointed out editorially in our May issue, only six out of 39 established world's records in aeronautics were (at that time) held by the United States, it isn't to be wondered at that many a citizen was willing to accept the bellowings of certain groups in this country at face value.

Fortunately, interest in bringing records back to this side of the Atlantic is showing signs of revival. Already, in the course of routine acceptance tests, the Sikorsky S-42 has recaptured by substantial margin ten "firsts" in as many F.A.I. categories. That brings the score up to 16 out of 39. At the moment, there are half a dozen ships completed, or in the final stages of construction, which could easily add materially to that total. To the N.A.A.'s present campaign to get more of the available talent to compete officially in the world arena, we add our endorsement. There is more to be gained than honor. It is just plain good business.

NEWS OF THE MONTH

★ AIR MAIL AND TRANSPORT . . . Safety regulations for airlines revised at Washington conference . . . Lower express rates established . . . I.C.C. orders operators to submit costs of mail carriage . . . United completes reorganization . . . General Air Lines announces $300,000 equipment program.

★ D. OF C . . . Light plane bids opened.

★ SERVICES . . . Representative Vinson drafts program for navy plane construction up to 2,184 . . . Navy officials decide 1910 planes to be ample peace time quota.

★ AIRWAYS AND AIRPORTS . . . Army board to report on Governors Island as an airport site . . . PWA surveys Chicago's Lake Front airport project . . . PWA to light airway between Washington and Nashville.

★ FOREIGN . . . Swissair uses Lockheed Orion for Balkan mail service . . . Air France sends two mail planes across South Atlantic . . . Belgians make stratosphere flight.

★ COMPETITIONS . . . Program of National Air Races . . . National Balloon Race . . . Women's National Air Meet.

Toward a new safety

WITH coats off and sleeves rolled up, airline operators, plane and engine manufacturers, sat with officials of the Bureau of Air Commerce through two sweltering Washington days, Aug. 15-16, to bring Air Transport Regulations Bulletin 7-E up to date. Prior to the public meetings, the operators had met privately under the auspices of the Aeronautical Chamber of Commerce to preview the proposed regulations and to draft their recommendations for changes.

Secretary of Commerce Roper opened the public hearings with a brief address of welcome on behalf of the Department, and was followed by Aeronautics Director Eugene L. Vidal, who outlined the need for revision of regulations now made obsolete by the adoption of high-speed equipment. Maj. R. W. Schroeder, chief of the Airlines Inspection Service, then took over the control of the meeting and steered it ably through the details of the revisions.

Before the end of the conference, virtually all the old airways regulations had been dumped overboard and new ones to fit modern conditions had been substituted. Airways were redefined as strips 50 miles wide with center lines connecting terminal points. Pilots are to be prohibited from flying outside of the defined airways unless forced to do so by extreme emergencies, in which case they must explain in writing to their superiors and to the Department of Commerce the reasons for such deviation. Air routes are to be subdivided into divisions, a division being considered that portion which is regularly flown by a pilot as a round trip. A separate letter of authority is to be written for each division to specify exactly the type of equipment to be used and the general method of operation. Pilots are to be authorized to fly in one division only and cannot be transferred to another until they have passed a rigid examination as to qualifications for the new run.

The control of operations within each division is to rest in the hands of a licensed dispatcher, a rating created by the new regulations. To be licensed, such an individual must meet a strict set of specifications and pass a rather formidable examination to assure airline inspectors that he is thoroughly familiar with the equipment, operations and peculiarities of his division. Certain airline officials protested vigorously the licensing of dispatchers, but the Department was firm on this point, and this requirement will probably be incorporated in the new regulations as finally issued.

Controversy also arose over the proposed limitations of pilots' flying hours. The Department's original proposal for a maximum total of 1,000 hours per year with not more than 100 hours flown per month, was contested by Edward G. Hamilton of the Airline Pilots Association. He asked for a limit of 85 hours per month in view of the general adoption of high speed ships. He suggested a careful study of piloting fatigue by competent flight surgeons before final decision. The matter was left in abeyance for the moment for further investigation.

In discussing aircraft and equipment, of prime interest to operators and manufacturers alike, was the recommendation that the engineering department specify in Aeronautics Bulletin No. 7-A that multi-motored aircraft, in the event of a motor failure during take-off with full load, shall be capable of taking off, climbing at an adequate rate and circling for landings (regardless of the position of the landing gear) at all airports contemplated for use as terminals or stops. Pilots will be required to demonstrate their ability to fly aircraft under such abnormal conditions before being authorized for scheduled passenger service.

A number of experts were called in to amplify certain aspects of the main discussion. Rex Martin, in charge of airways communications for the Department, spoke of new developments now under way in radio navigational aids,

Calendar

Aug. 28-Sept. 15—International Touring Competition, Aero Club of Poland.

Aug. 31-Sept. 3 — National Air Races, Cleveland.

Sept. 10-16—Sixth Indiana Air Tour.

Sept. 15-30 — Soaring Contest, Soaring Society of America, Big Meadows, Va.

Sept. 23 — Annual Gordon Bennett Balloon Race, Warsaw, Poland.

Sept. 27-29—Fourth annual Meeting, National Association of State Aviation Officials, Cheyenne, Wyo.

Oct. 11-13—Annual meeting, National Aeronautic Association, Washington, D. C.

Oct. 20 — MacRobertson International Air Race, London to Australia.

Nov. 16-Dec. 2 — Exposition Internationale de L'Aeronautique, Grand Palais, Paris, France.

Dec. 15-16—Viceroy's Challenge Trophy 700-mile race, India.

landing devices, radio teletype services. Melvin C. Gough, test pilot for the N.A.C.A. at Langley Field, outlined the work the committee is doing to set up a specification for pilot vision for aircraft, and exhibited a number of typical charts made with the visiometer. (See AVIATION, July, 1934). Available also were two important statistical studies made by the department. The first was an analysis of 414 mechanical forced landings reported on scheduled airline operations between June 29, 1933, and July 17, 1934 (failures were reported as follows: 280 engine, 35 personnel, 34 radio, 28 propeller, 19 instrument and 18 airplane). The second showed flight interruptions due to weather as reported by scheduled airlines for the period Aug. 22, 1933, to July 6, 1934, analyzed the reasons for the landings and broke down the weather conditions involved.

The new regulations are to be put in final form by the department immediately, and will become effective Sept. 1. It was recommended that similar meetings be held annually to consider revisions indicated by the rapidly advancing state of the art.

PROGRAM OF EVENTS FOR 1934 NATIONAL AIR RACES

CLEVELAND MUNICIPAL AIRPORT

Date	Event No.	Trophy	Distance	Course	Engine Limitation (cu.in.)	Total Purse	Qualifying Speed (m.p.h.)
Aug. 31	1	.....	50 mi.	10 laps	375	$1,400	175
	2	Shell	3 km.	straightaway	375	1,000	...
	3	Greve	50 mi.	10 laps	550	1,700	200
	..	Bendix	2,100 mi.*	.....	none	10,000	...
Sept. 1	4	.....	15 mi.	3 laps	200	400	125
	5	.....	50 mi.	10 laps	375	1,400	175
	6	Shell	3 km.	straightaway	550	1,500	...
	7	Greve	50 mi.	10 laps	550	1,700	200
Sept. 2	8	.....	15 mi.	3 laps	200	400	125
	9	Greve	50 mi.	10 laps	550	1,700	200
	10	Shell	3 km.	straightaway	none	....**	...
	11	.....	50 mi.	10 laps	1,000	1,700	200
Sept. 3	12	.....	50 mi.	10 laps	375	1,400	175
	13	Shell	3 km.	straightaway	none	2,500	...
	14	Thompson	100 mi.	20 laps	none	5,000	225

*Los Angeles to Cleveland (refuelling stops optional). **Events No. 10 and 13 are considered one competition.

Express rates slashed

Substantial reductions in rates for light weight air express shipments, which at present constitute a large percentage of the packages handled, were established Aug. 15 by the Air Express division of the Railway Express Agency and by General Air Express. The new tariffs, uniform for both groups, provide a flat rate of 85 cents for ¾ lb. or less, and $1 for 1 lb. packages for delivery to any airline city in the country served by these two systems. Previous rates on packages of these weights ranged from $1 to $1.80 and were dependent upon the distance of carriage.

The Railway Express Agency has, in addition, established a new rate of $1 for packages weighing up to 25 lb. between cities less than 150 air-miles apart. General Air Express has affected a lowering of tariffs by dividing its express system into 24 zones of 100 miles each instead of the former arrangement of 59 zones of 50 miles each. For example, under the new rates there is a reduction from $3.20 to $2.75 for a 5-lb. shipment to Miami. Northwest Airlines recently became a member company of General Air Express, thus supplying the system with a direct outlet to the Pacific Northwest for the first time.

Tours and excursions

With travel by air becoming commonplace, airlines begin more and more to offer services similar to those of surface transport. A special summer excursion rate recently put into effect by Eastern Air Lines on the New York-Atlanta-New Orleans route has brought substantial traffic gains. The round trip from New York to New Orleans now costs $103.36. The old rate was $134.02. Tickets are good for 30 days and permit stop overs at any city along the route.

Combined air and sea cruises around South America are listed on Thomas Cook's fall schedule in cooperation with Pan American Airways. Flights from Miami to Rio de Janeiro in the new Brazilian Clipper, and over the Andes in Pan American's tri-motor Fords are included in the itinerary. The use of airplanes makes it possible to accomplish the 17,000 mile journey in six weeks instead of the three months required by steamer.

In Europe the chartering of airliners for sightseeing cruises has for some time been a feature of tourist travel, especially on the route over Switzerland and around the Mediterranean coast. Recently a two weeks tour of the principal cities of Europe was made by a group of 24 persons in an Imperial Airways Handley-Page.

I.C.C. takes hold

All transport companies carrying air mail were ordered to submit statements to the Interstate Commerce Commission before Sept. 10 showing the cost of operating their planes and of flying the mails. The I.C.C. will begin hearings toward the last of the month on these costs and their relation to the present schedule of payment by the government. Although the I.C.C. is specifically directed by the Air Mail Act to fix reasonable rates for the transportation of air mail, the Post Office Department filed an objection to the investigation on the grounds that the commission does not have jurisdiction to fix rates over routes being operated under the temporary contracts. Under the terms of the new law, the I.C.C. may increase rates, provided they do not exceed 33⅓ cents per airplane-mile for a load under 300 lb., or over 40 cents per airplane-mile for any condition of load.

D. of C. light plane bids

Bids from fourteen manufacturers were opened Aug. 27 by the Department of Commerce for the production of 25 small planes to be used by its inspectors. (Complete specifications were printed in AVIATION, July, page 208). The bids of Safety Air Transportation Company, Campbell Aircraft Company, and Church Airplane & Manufacturing Company were not accompanied by bonds. No definite date has been announced for the contract award. The bids submitted and the prices asked were:

Safety Air Transportation Company of Indianapolis, $750.
Campbell Aircraft Company, St. Joseph, Mo., $1,650.
Church Airplane and Manufacturing Company, Chicago, $1,695.
Waldo D. Waterman, Santa Monica, Calif., $2,493.87.
Hartford Aircraft Company, $2,650.
Curtiss-Wright Airplane Company, Robertson, Mo., $2,995.
Hammond Aircraft Corporation, Ypsilanti, Mich., $3,190.
Niagara Amphibions, Buffalo, $4,000 each for ships with metal hulls and $3,250 for wooden hulls.
St. Louis Aircraft Corporation, $3,395.
Arrow Aircraft and Motor Corporation, Lincoln, Neb., $3,495 for planes equipped with Kinner K-5 engines and $3,995 for Kinner B-5 power plants.
Spartan Aircraft Company, Tulsa, Okla., $3,750.
Kreider-Reisner Aircraft Company, Hagerstown, Md., $6,200.
Cunningham-Hall Aircraft Corporation, Rochester, N. Y., $6,425.
Amphibions, Inc., Roosevelt Field, L. I., $6,670.

Industry reports

Stocks of United Aircraft Corporation, United Air Lines Transport Corporation, and Boeing Airplane Company —the three companies created by the reorganization of United Aircraft & Transport Corporation in accordance with the provisions of the new Air Mail Law—have been approved for listing on the New York Stock Exchange. The new securities registered with the Federal Trade Commission include 2,203,319 shares of United Aircraft Corporation common stock at $5 par; 1,101,659 voting trust certificates of United Air Lines Transport, representing as many shares of common stock at $5 par; and 550,829 shares of Boeing Airplane Company, common stock also at $5 par.

For the second quarter of 1934 United Aircraft & Transport Corporation reported a consolidated net loss of $1,267,536, comparing with a net loss of $788,547 for the first quarter and a net income of $848,258 or 35 cents a share on the common stock after preferred dividends, in the second quarter last year. For the six months ended June 30, the net loss amounted to $1,978,926, as compared with a net income of $1,280,429, or 50 cents a share on the common stock in the 1933 period.

Net loss for the transport companies during the six months' period was approximately $1,508,000. According to the report, this was due principally to the absence of air mail revenues during the cancellation period, and to the reduced revenues in effect after the resumption of air mail service under temporary contracts.

Western manufacturing companies had a net loss of about $631,000 for the half year, due mainly to losses in connection with deliveries made during the period by the Boeing Airplane Company on a contract for Army airplanes.

The Eastern manufacturing group had a net profit of about $160,000 for the same period, but results were adversely affected by the strike from April 10 to May 21 at the Pratt & Whitney aircraft plant at Hartford, Conn., which compelled a shut-down during that period.

Unfilled orders on June 30 were $1,431,000 for the Western and $1,327,000 for the Eastern airplane manufacturing group, and $4,919,851 for the engine and propeller companies.

Also reporting a loss for the six-month period because of reduced mail revenues is Aviation Corporation and subsidiary companies.

Consolidated net loss was $1,144,634 comparing with a profit of $321,057 for the same period of 1933. Mail revenue for the six-month period was $719,709 a drop of $1,946,806 from the corresponding months last year. Passenger revenue also dropped $56,686 to $748,336. Total transportation revenue in the first six months of 1934 was $1,530,137 as compared with $3,523,261 for last year.

Merger postponed

Interest has been aroused in financial circles by reports that National Aviation Corporation is negotiating for the purchase of Eastern Air Lines from North American Aviation, now 52 per cent owned by General Motors interests. It is also reported that National Aviation is completing arrangements for the purchase of the assets of Air Investors, Inc. The purchase of Eastern Air Lines would establish a new policy for National Aviation which heretofore has not been an operating organization. Last year the company formed National Air Lines for the purpose of establishing transport service between New York and Washington, but operations were not started. It also owns the Washington airport and an undeveloped airport site near Washington.

Meanwhile immediate purchase of a $300,000 fleet of airplanes with a cruising speed between 190 and 200 m.p.h. was announced by General Air Lines. Specifications call for twin-motored low-wing all-metal planes seating from ten to fourteen passengers. With the new equipment, flying time over the company's 700 mile route from San Diego to Salt Lake City will be cut from six to approximately 3½ hours..

To build or not to build

A new five-year naval air expansion program calling for an increase in fighting aircraft and pilots is being drafted by Representative Vinson, chairman of the House Naval Committee, in cooperation with the Navy Department for presentation to the next Congress. The projected program calls for construction up to the 2,184 quota, authorized by the Vinson Treaty Navy Bill. Development of the Philadelphia naval aircraft factory and an increase in the facilities of the Pensacola Naval Aviation and Training School are also involved.

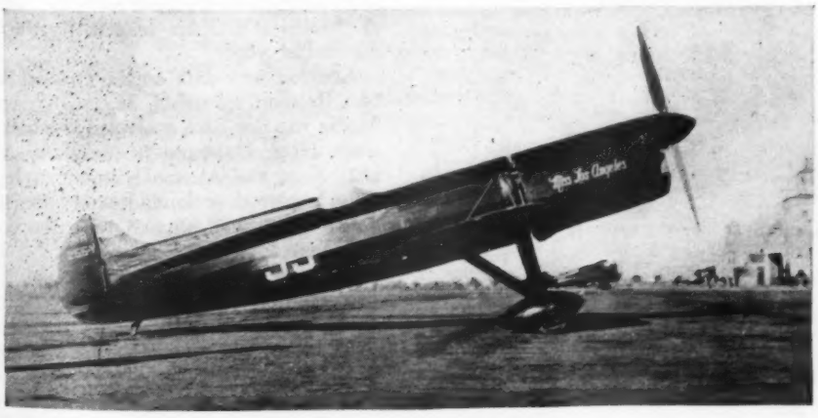
While Representative Vinson was urging expansion of naval air forces, Secretary of the Navy Swanson proposed a general reduction of 20 per cent in naval armament by all the powers signatory to the London Treaty. At the same time, Admiral William H. Standley, chief of naval operations, announced that the Navy had decided that 1,910 planes, 274 fewer than called for in the Vinson proposal, was ample for peace time requirements.

The newly-commissioned aircraft carrier USS Ranger sailed on her shakedown cruise to Rio de Janeiro Aug. 17, and will return to Hampton Roads, Va., the middle of October. Construction work on the Navy's two new carriers is now under way. The keel of the Yorktown was laid in May, that of the Enterprise in July. Like the Ranger, each vessel will carry 72 airplanes. Each will cost $18,000,000 and have a displacement of 20,000 tons.

Airports

The perennial question of constructing an airport on Governors Island in New York harbor seems nearer solution than ever before with the appointment by the War Department of a board of four Army officers to study the suitability of the military reservation as a landing site. Under the War Department Appropriation Bill for the fiscal year 1935, funds for surveying the island were allotted to the President. The one aviator on the commission is Maj. William E. Lynd, Air Corps. The others are Col. James A. Woodruff, Engineers Corps, Maj. John D. Kilpatrik, Quartermaster Corps, Maj. William F. Thompkins, General Staff. Since the island is only a short distance from downtown Manhattan it has many potential advantages over existing airports as a terminal for lines serving the city.

A special committee of five members representing both the city of Chicago and the Federal Government was appointed by Public Works Administrator Ickes to determine the best site for a



CLEVELAND BOUND

A Menasco powered racer built for Roy Minor by the Lawrence W. Brown Aircraft Company, of Los Angeles. With a top speed of 270 m.p.h. it is entered in several events at the National Air Races.

central airport in the city. Mayor Kelly has proffered the technical services of city engineers to assist the committee in their survey. Though no financial aid for construction of an airport has been promised by the government, the committee will look over all possible sites and make a complete report. Application for an allotment of $8,600,000 to build an island airport in Lake Michigan has been filed with PWA but no acceptable method of reasonably securing such an allotment, as required by the National Recovery Act, has been presented. Sharp difference of opinion over the advisability of a lake-front airport will be laid before the commission for settlement. Advocates of the project offer as its chief advantages that it would be near the downtown district and would provide large employment. Opponents have laid a seven point program of protest before PWA officials. Among their major objections is the fact that after years of effort Chicago has freed its lake front of industrial domination and the establishment of an island airport would therefore constitute a backward step. They also argue that while such an airport would be close to the downtown section, it would not be close to the center of population, and claim that the proposed field would be too small to permit safe landings in foggy or stormy weather.

As part of the work-relief program for the drought area, a fund of $71,147 was allotted to the Federal Emergency Relief Administration by PWA to aid airport construction. Representing approximately 22 per cent of the construction cost of the proposed airports, the fund will be used for materials, equipment and supervision. The airports in the program originally were part of the Civil Works program on which work was suspended when the CWA appropriation ran out.

HERMAN GLAUERT, principal scientific officer of the Royal Aircraft Establishment at Farnborough, England, died Aug. 4 from injuries received when he was struck by debris from a blasting explosion. Engaged in aerodynamic research since 1916 he was the author of innumerable technical papers and reports. His best known work, a book, "Elements of Aerofoil and Airscrew Theory" had been of great importance in disseminating the Prandtl theories among English speaking scholars.

FRANCES MARSALIS, co-holder of the woman's refuelling endurance record, was killed when her plane crashed rounding a pylon at the Women's National Air Meet at Dayton, Aug. 5. Miss Marsalis had long been nationally known as one of the country's most active women pilots. For some months prior to her death she had been flying saleswoman and demonstrator for Waco Sales of New York, Inc.

Airways

For the installation of a lighted airway from Washington, D. C., to Nashville, Tenn., the Public Works Administration allotted $465,000 to the Bureau of Air Commerce. Construction of the 580-mile airway which runs via Lynchburg and Roanoke, Va., through Bristol and Knoxville, Tenn., will not only eliminate the present emergency flying conditions on the route but will open a direct route from Washington to the Southwest.

Another recent allotment by PWA to the Bureau of Air Commerce was a fund of $508,000 to hasten the completion of a series of air navigation maps of the United States. Under the Bureau's yearly Congressional appropriation the series of 87 maps contemplated in the Air Commerce Act of 1926 could not have been completed in less than ten years.

Foreign affairs

A special high-speed mail service through the Balkans is being arranged by Swissair with Lockheed Orions. In a trial run over the route recently, one of the Orions owned by the company covered the 2,784 miles in one day, making an average speed of 182 m.p.h. Starting from Zurich the plane flew to Naples, Athens, Istanbul, Belgrade, and Pfullendorf, then back to Zurich.

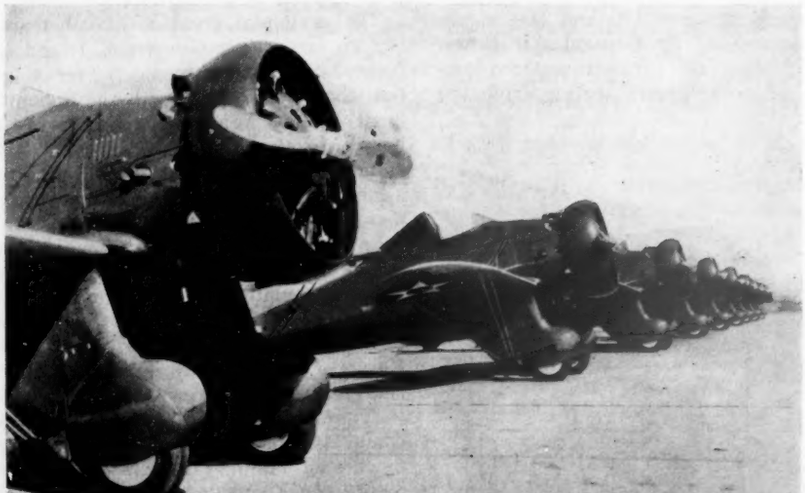
In a further effort to establish regular air mail service between Paris and Buenos Aires, Air France carried out two flights across the South Atlantic Aug. 1. Making her fourth crossing, the Arc-en-Ciel, Couzinet mail plane, flew from Natal to Porto Praya in the Cape Verde Islands at an average speed of 119 m.p.h. Total elapsed time was 14 hours, 35 minutes. At the same time the Croix-du-Sud, Latécoère flying boat, was crossing the Atlantic in the opposite direction from Dakar to Natal. Total elapsed time 19 hours, 35 minutes, average speed, 102.5 m.p.h.

In an attempt to fly non-stop to Baghdad and break the long-distance record of 5,657 miles held by Codos and Rossi, James Alying and Leonard Reid set out from Wasaga Beach, Ontario, Aug. 8. Thirty hours 51 minutes later they landed at Heston Airport, England, 3,500 miles from Canada. The fuel supply had run too low to enable them to reach their mark, and there was therefore no purpose in continuing. Their plane, renamed Trail of the Caribou, was originally the Seafarer, a DeHaviland Dragon Moth built for Capt. James A. Mollison and his wife to fly the Atlantic last year.

Seeking new data on the stratosphere, two Belgian scientists, Max Cosyns and Meere van der Elst, ascended in a balloon from Hour-Havenne in Belgium, Aug. 18. Near the Austro-Hungarian-Jugo-Slav border they landed safely fourteen hours later, well-pleased with the completeness of their observations. The balloon attained its maximum altitude (52,480 ft.) a few hours after take-off. Two years ago M. Cosyns made a stratosphere ascent with Prof. Piccard.

National Balloon Races

Winner of the National Balloon Races at Birmingham, Ala., July 31, was a Navy balloon piloted by Lt. Charles H. Kendall and Lt. Howard T. Orville,



ROUND-UP

A group of high-speed, single-seater Boeing P-26A pursuit planes lined up in Seattle preparatory to delivery to the Air Corps. Designed for combat work at high altitudes, these low-wing fighters are powered with supercharged Pratt & Whitney Wasp engines.

who will represent the United States at the International Gordon Bennett Race at Warsaw Sept. 23. Taking off at 10:40 p.m. the Navy balloon of 80,000 cu.ft. capacity landed 206.4 miles away near Commerce, Ga., at 9 p.m. the following day. Second was Army entry No. 2 with 180 miles. The other three entries, Goodyear VII, Buffalo Courier-Express, and Army entry No. 1 were grounded a few hours after take-off.

Women fliers meet

With one event remaining on the program the Women's National Air Meet, held at Vandalia near Dayton, Ohio, Aug. 5-6, came to an abrupt close when Frances Marsalis, well-known record holder, was fatally injured in the 50-mile handicap race. Finishing first in the event was Edna Gardner, who was later disqualified by the handicappers. First prize of $1,000 was awarded to Helen Richey, 2d to Alma A. Davis, 3d to Gladys O'Donnell. The meet opened with a 20-mile handicap race over a triangular course, won by Jeannette Lempke with Annette Gipson, second. Ellen Smith, finishing only 45 in. from the line won the precision landing contest. Preceding the races was held the annual convention of the Women's Aeronautical Association, which together with the Ninety Niners sponsored the meet.

Aviation People

• **Maj. Edwin E. Aldrin,** in charge of the aviation department of the Standard Oil Company of New Jersey, sailed recently for Europe where he will coordinate the overseas interests of the Stanavo Specification Board, and the Standard Oil Company of New Jersey. In addition to visiting various points on the continent and witnessing a number of aviation events, Major Aldrin will take an active part abroad in supervising the arrangements Stanavo distributors are making to supply fuels and lubricants for the entrants in the MacRobertson Trophy Race in October.

Maj. Edwin E. Aldrin

• On a similar mission goes **Henry J. White,** aviation sales manager of the Socony-Vacuum Company, with a new Beechcraft four-place cabin plane. He will tour Europe by air in company with W. L. Faust, head of the marine and aviation divisions of Socony-Vacuum.

• Several British aviation experts have recently visited the United States. **Maj. Thomas M. Barlow** and **Maj. M. A. E. Wright,** of Fairey Aviation Company, Ltd., makers of military planes, made a tour of the country to survey various aspects of American aviation. Major Barlow has been chief engineer of Fairey since 1924, and a director since 1929. Major Wright is also a director of the company.

Capt. Harold H. Balfour, Member of Parliament, and director of Spartan Aircraft Company, made a particular study of our commercial airlines. Captain Balfour is one of the executives of Spartan Airlines in England.

To collect data for use in building an airport in the Straits Settlements Singapore, **Maj. R. L. Nunn** made an inspection tour of the leading airports in the United States. Major Nunn is director of Public Works in the Straits Settlements.

• The position of Tampa airport manager for Pan American Airways has been recently assumed by **H. G. Arnold,** succeeding **W. T. Jarboe,** who will be transferred to another post. Mr. Arnold has been with Pan American for three years, mostly in Cuba.

• **John Porter,** in charge of the aviation department of the Standard Oil Company of Indiana received a silver medal from the Italian government for exceptional efficiency and cooperation in refueling Italy's fleet of 24 seaplanes during its visit to Chicago last summer.

• New manager of the Paul Baer Municipal Airport at Fort Wayne, Indiana, is **Capt. Clarence F. Cornish,** of the Army Air Corps Reserve. A pilot and instructor of long experience, Captain Cornish was recently manager and secretary-treasurer of Aereco Flying Service at Fort Wayne. He succeeds Capt. Robert R. Bartel.

Under the new Aereco set-up **Louis Niezer** will replace Captain Cornish, while **Charles Hull** will be operations manager. Both of the new officers of the company have been connected with the service for several years.

• **Stanley H. Evans,** recently Dean of the Engineering School in the Curtiss-Wright Technical Institute at Glendale, Cal., has returned to England to take charge of the airplane division in a newly-organized aircraft and engine manufacturing plant. Mr. Evans, who had been in charge of the school for more than three years, was succeeded by **Carleton E. Stryker.** An authority on metal construction, Mr. Stryker has had a long and varied experience in the industry. In the past he has been connected with several manufacturing companies, including Curtiss, Northrop, and Vultee.

• **Capt. Eugenio Minetti,** of the Italian Air Corps, has been appointed general agent for the sale of Fairchild airplanes in Italy, France, and Austria. Captain Minetti is in charge of the Milan office of the firm Minetti and De'Paoli of New York.

• A nationwide survey of small plane engines, including those still in the experimental stage was recently completed by **Phoebe Omlie,** in her capacity as Special Assistant for Air Intelligence of the National Advisory Committee for Aeronautics. Her three-month air tour of the country was carried out in connection with the federal program to foster light plane development. Mrs. Omlie is among the most experienced of present day active women pilots, having learned to fly in 1921. She has participated in many National Air Tours and has been a successful competitor in several derbies. Since 1921 she has been active in the management of Mid South Flying Service at Memphis, Tenn., established and operated by her husband and herself.

Phoebe Omlie

• After spending seven months in Amsterdam where he instructed K.L.M. pilots in American methods of instrument flying, **Howard C. Stark** has returned to this country. While abroad Mr. Stark studied communications and radio systems on European airlines. Well-known here as a pioneer in the development of instrument flying technique, Mr. Stark is the author of "Blind or Instrument Flying" which he is in the process of revising.

• The Aeronautical Chamber of Commerce is now installed in its new quarters in the Shoreham Building at Washington, having moved from New York Aug. 10. **Leighton W. Rogers,** executive vice-president, **Charles E. Parker, Fowler W. Barker** and several other members of the staff are in the Washington office, while **Howard Mingos,** editor of the Aircraft Yearbook, is in charge of the New York offices, including the library, which have been transferred to the RCA Building at Rockefeller Plaza.

Flying Services and Flying Schools

• Forty airplanes carrying about 150 persons took off under ideal weather conditions from Roosevelt Field, Long Island, N. Y., on the third annual good-will cruise to Montreal, Saturday, Aug. 18. On their way up the Hudson they were joined by other cruisers from New Jersey and Westchester airports, and proceeded by way of Troy, Lake George, and Lake Champlain to St. Hubert Airport, Montreal. There, the American delegation met Canadian cruisers from the Maritime Provinces and from Toronto. The visiting fliers were greeted by civic authorities and by officers of the Montreal Light Aeroplane Club who were their hosts overnight. The return trip on Sunday was made by way of the east side of Lake Champlain, clearing customs at Swanton, Vt. The Bureau of Air Commerce was represented on the flight by Col. J. Carroll Cone, assistant director in charge of regulations. Chairman of the general committee was Major LaGuardia, who was represented on the cruise by F. William Zelcer, commissioner of aviation for New York City. Kester S. Lindsay, operations manager of Roosevelt Field, was in charge of arrangements.

• A Ford transport with three Wasps and a Hornet-powered Boeing 40-B have been added to the Boeing School fleet, making a total of eleven units of equipment operated for pilot training. The Boeing is equipped for blind landing practice with the newly installed Bureau of Standards landing beam beacon located at the Oakland (Cal.) airport. Its use will be shared by Boeing students and the flying personnel of the Oakland division of United Air Lines.

• Twenty-one aviation schools for ground and flying instruction in the United States have approved school certificates from the Department of Commerce, according to an official list recently published by the Bureau of Air Commerce. The four names added this year include Westfahl Airways, Milwaukee, Wis., in conjunction with Wisconsin School of Aviation; Chicago Aviation Corporation, Glenview, Ill., in conjunction with Aeronautical University, Inc.; Erickson & Remmert, Brooklyn, N. Y., in conjunction with New York University Ground School; Inter City Airlines, East Boston, Mass.

• More than 60 students were enrolled for the summer courses at Curtiss-Wright Technical Institute at Grand Central Air Terminal, Glendale, Cal. Among them were 23 high school teachers from various parts of the state who took special vocational training courses to meet the demands of their students for instruction in aeronautics.

• The Plane-Speaker Corporation, owners and promoters of the Voice of the Sky franchise, have recently announced an important change of policy. Heretofore they have never leased any equipment or permission to use the Voice of the Sky directly to any business group, preferring to deal with operators of aircraft who would form their own contracts with advertisers. From now on the company plans to deal directly with advertisers as well as with aircraft operators. First customers are to be the Puroil Companies of Chicago and the Carolinas and the Wofford Oil Company of Georgia who have purchased the exclusive oil advertising rights for 32 states. A Bellanca and a Fokker Universal have already been fitted for them.

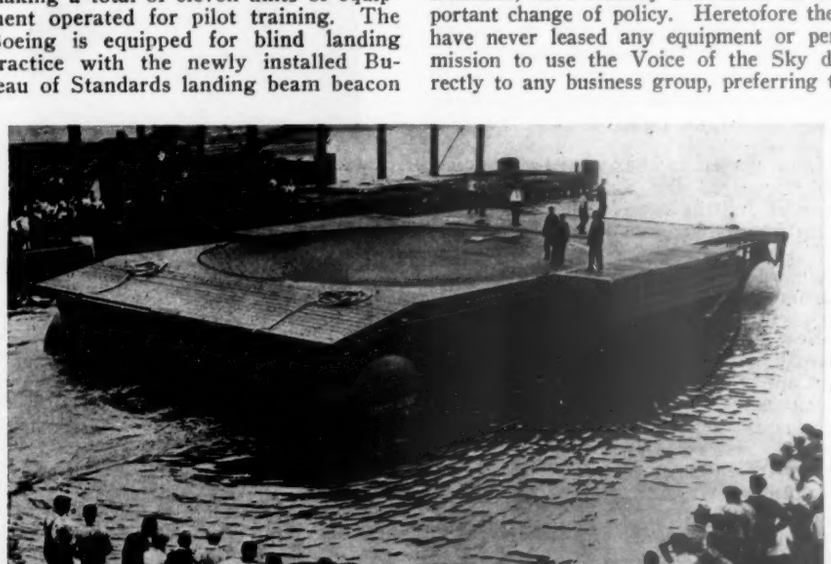
• With an 82 per cent gain in gross sales for the first six months of 1934 and unfilled orders on hand in excess of $100,000 Pacific Airmotive Corporation parts, accessories and repair base at Glendale, Cal., reports the busiest half-year in its history. According to W. E. Thomas, president and treasurer of the company, sales totaled $253,777 as against $139,758 for the corresponding period last year. Net profit for the first six months after all reserves had been taken care of was $6,692, as compared with a loss last year of $5,952.

• At the municipal airport in Cleveland, General Automotive Corporation has completed the installation of equipment for their new base. They will specialize in repairing and overhauling planes and engines, and provide service and storage facilities to visiting pilots. General manager is James W. Borton, formerly manager of Thompson Aeronautical Corporation's Cleveland base, and lately operations manager at Albany for American Airlines. R. E. Doyle, likewise connected in the past with Thompson Aeronautical Corporation and American Airlines, has been appointed director of engine overhauls.

• The Atlanta branch of the Stinson Air Cab Service, first to be established in the South, has begun operations at Candler Field. With a new Stinson Reliant, F. H. Coons, transport pilot, provides cross-country trips for three passengers. The plane will be stored and serviced by Hightower Flying Service which opened recently in the hangar built for American Airways, Inc.

• A new corporation, Baro-At Sales, Inc., is being organized at Roosevelt Field to take over the Stinson contract of Atwell Sales Company. In addition to servicing Stinson planes, the company will take care of Lycoming engines and Smith controllable pitch propellers. Officers and owners are George Atwell, Jr., and R. S. Barbin, long established as Stinson pilots and salesmen.

• To give better service to Fairchild owners and agents in the New York, New Jersey, and New England territories, a new distributing organization has been set up at Roosevelt Field, Long Island. Headed by Manola Weichers, president of Plykrome Corporation, New York, the active operation will be directed by Beckwith Havens



WALL STREET SKYPORT

The first of two 165-ton seaplane ramps built by New York City after it was launched at the Brooklyn Navy Yard, Aug. 15. It will be moored at the foot of Wall Street in the East River. The second ramp, now nearing completion, will be moored at the foot of East 34th Street.

and Richard H. Depew, Jr., whose flying experience dates from 1911 and who have long been active in the field of airplane sales and service. For the past two years Mr. Havens has been Fairchild's eastern factory representative while Mr. Depew was lately associated with the Aviation Country Club at Hicksville, L. I.

• Island Air Lines is operating a commuting schedule of four round trips daily between New Bedford, Woods Hole, Vineyard Haven and Nantucket. President of the line is Robert Bell, formerly of Marine Air Transport. Burnham Litchfield is vice-president, and Charles Ripley, secretary. They are using a six-passenger Fairchild 71, Wasp powered.

• From Boston, daily flights to Nantucket are offered by the Gray-Lord Air Lines in a twin-engined Sikorsky amphibion. One round trip is made each day except Sunday with intermediate flag stops at New Bedford and Edgartown on Martha's Vineyard. Parker Gray, Nantucket flyer and commissioned officer in the Naval Aviation Reserve Corps, is head of the line. Associated with him is Maj. Frederick Lord.

• A group of aeronautical engineers connected with the Consolidated and Curtiss Companies have formed a Balloon Club for their lighter moments away from the problems of the design and construction of heavier than air craft. Two free balloon flights have been made to date. Carl Hineman of Consolidated and an expert balloonist of Gordon Bennett Cup Races fame is the guiding spirit of the club.

• A record in passenger safety has been made by the 103 members of the Stinson Air Cab Operators' Association. In the past twelve months their planes flew 3,415,620 miles without injury to a single passenger.

SIDE SLIPS

By Robert R. Osborn

THE National Air Races again! For one reason we're always glad to see them coming along—everybody in aviation seems to turn up at the Air Races each year, and we are always glad to see old friends again. Lately, times being what they are, most of the boys turn up to try to get jobs from friends who either are looking for jobs themselves or else have no jobs to offer, but that doesn't seem to detract from the good spirit of the annual meeting. The trials and tribulations of the past year are discussed over cigars and beer under the stands while the races are going on out front, or in crowded hotel rooms at night, and at the end of the meet everybody goes home happy, but wondering why he ever turned up again for another race meeting.

For another reason we are sorry to see the races come along each year, they are a sure sign that summer is on the wane, the frost is on the pumpkin, the corn is in the shock (as much of it as survived the drought and the A.A.A.) and the snow will soon be flying. Years ago we used to have a sure sign of spring in the annual flight of the Army "Owl" at Mitchell Field; we have lost that harbinger of the seasons, but we still have the sure sign of approaching fall, the National Air Races.

We see that the Brothers Henderson have decided that the Lady Birds will not be permitted to race this year, this year's meeting to be a strictly stag affair. We understand that the reason given for this ruling is greater safety and conservatism. However we suspect that there is another reason of greater importance which is not being mentioned, and that is the outfits in which our fair pilots attire themselves. In the past it has been practically impossible for the announcer to work up interest in some handicap race of six low-powered air-

planes, while some lady pilot has been parading in front of the stands in an outfit composed principally of shorts. If the races turn out to be a financial failure this year we'd suggest that this ruling might be reconsidered for the following year.

Speaking of racing reminds us to assume the privilege of extending a welcome to the aviation pioneer who is visiting these shores with the hope of lifting America's Cup with his yacht, "Endeavour." We have a great desire to take part in a yacht race of this sort, and absolutely no desire to watch it, somewhat the opposite to our reactions in regard to air racing. We think the best job of yacht race reporting ever done was by the great Ring Lardner years ago. Half of his article described the poker game going on below decks on the Press boat, the other half describing an accident to a sight-seeing blimp when it fell into the water.

However, all joking to one side, we are glad to see a member of the aeronautical industry representing his country in this great sport, and we are sure he has already proven himself capable of carrying on the good work of the great sportsman and good fellow who was his predecessor.

In the last month's article we wondered why the altitude record of Mr. Donati of Italy was never officially checked, as we were very much interested in determining ***exactly*** how high he had managed to go. A correspondent sends us a clipping from a paper published way back in April showing us that we must have overlooked the dispatch, as the matter was looked into very thoroughly; "Rome, April 12th—(AP) Renato Donati, Italian Air Ace, reached an altitude of 14,433 meters (947,308.28939 ft.) yesterday, it was officially announced today, when the barograph was checked."

Following our usual practice of calling attention to anything new which might be "for the good of the game", we pass along the following letter received by a banker friend of ours, as he has decided not to back the proposition offered to him and thought someone else might be interested:

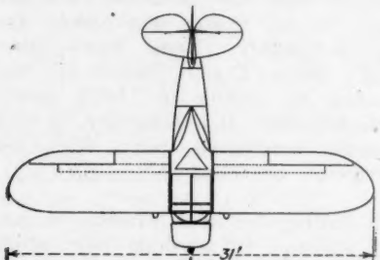
"Dear Sir: I am writing as to a newly improved transport model plane I am a Designer of newly improved planes my plane is a low wing open copit 4 passaggers in front copit in back copit polit and cop polit side By side if you arc inetered you care to come up or send a Designer or let me know I can come their I am alomost sure you would be be instered if you saw the draft of it."

An unknown correspondent sends in a clipping from a Mexican newspaper which indicates that some of the Mexican reporters are not any more familiar with American aviation than were some of the members of the Congressional committees last winter. You may remember that we reported one Congressional committee member who asked questions for over half on hour about the Vought Corsair, from which questions

one could tell he didn't know whether it was a motor, propeller, or airplane. Our Mexican reporter does equally well by referring in his article to "la Vogue Corsaires Co."

FLYING EQUIPMENT

The two-place Luscombe Phantom is powered with the 145-hp. Warner Super Scarab.



The Luscombe Phantom

WHEN D. A. Luscombe resigned from the Monocoupe Corporation early last year, he left a project to which he had been making substantial contribution from its inception. As pilot, salesman, manager, and president he had shaped the Monocoupe development. In no small measure its success had been his success. When he joined forces with I. H. Driggs, designer of a series of noteworthy planes from the famous Dart of a decade ago to the Skylark of recent production, the industry had therefore a right to expect an interesting aircraft.

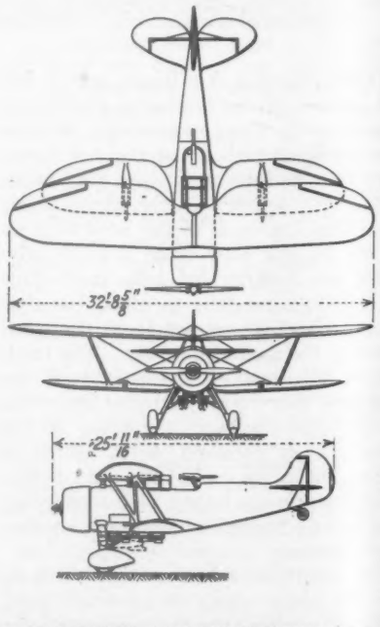
The Luscombe Phantom now being demonstrated is all of that. From its tail wheel to its forced-cooling cowl it is replete with advanced structural innovations and design refinements. Designed to take its place among the quality group of planes for the private flyer it should prove a worthy competitor of the distinguished American craft which have earned success in that market. Already seven are being built at the Kansas City, Mo., factory to fill orders on hand.

A two-seater, high-wing, cabin monoplane, it has been designed from first to last with an idea of developing high top speed and maneuverability. With an all up weight of 1,950 lb. and a wing area of 132.5 sq.ft. it has a top speed of 168 m.p.h. when equipped with a Warner Super-Scarab. Like the modern high performanced ships of larger classes it has a nicely streamlined circular duralumin fuselage of monocoque construction. Its landing gear, while not retractable, is aerodynamically simplified to a high degree. Strut ends, aileron hinge slots and the tail wheel have been carefully faired. There are no external control horns. The landing lights are entirely encased within the wing contour. Wing fillets and the transition from wing to fuselage top are of good shape. As we shall see, even the exposed riveting has been kept to a minimum.

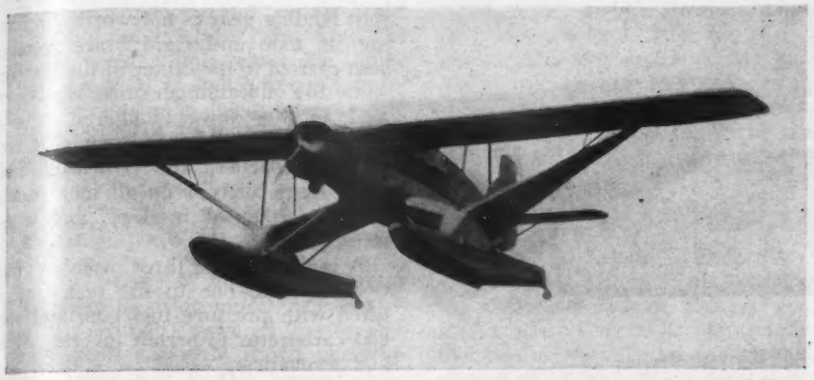
Of particular interest is its use of wing flaps to recover the slowness of landing speed its wing loading would otherwise cost it. Extending from close to the wing stub to the outer end of the aileron and lying immediately in front of the aileron is a flap of approximately 6 in. chord. Operation, manual or by electric motor, is rapid, though designed to function against the loads experienced in a terminal velocity dive.

The stabilizer, mounted high above the fuselage on the fin, is adjustable about its trailing edge. The fin is not offset but has an increased camber on its left hand face to accomplish the same purpose. Aileron control is ample even with flap down and at the stall. The ship spins and recovers neatly and is capable of a full repertoire of aerobatics. Its initial climb is 1,400 ft. per min. and with the flaps down it lands easily at 45 m.p.h.

It has many ingenious though rather unorthodox structural features, chief of which is the fuselage structure. In place of the more common elaborate-bulkhead thin-skin combination, the monocoque of the Phantom is built of a thick (.065 in.) skin of 17ST dural shaped under a power hammer to a double curvature. There is a transverse bulkhead braced by a steel tube triangle immediately aft of the cabin, and an orthodox dural bulkhead in the plane



The Waco D is designed to accommodate engines up to 420 hp. It is available for both military and sport purposes.



The new Bellanca Seaplane Aircruiser in flight. Retaining many of the old Airbus features, it is the product of a completely new engineering approach. Floats by Edo.

of the stabilizer struts but there is no other bracing between them except dural angles (less than 2 in. on each leg) which back up each transverse joint between skin plates—and, since there are only twelve skin plates in the entire fuselage exclusive of cowl, doors, and wing fillets, there are few of these.

The fin is also of all metal construction and built rigidly onto the fuselage. Other tail surfaces are of welded steel tubing with fabric covering. The landing gear is full oildraulic with a 6½-in. travel. A single large streamlined wire connects the two legs. The tail wheel is small and of solid rubber being mounted on a fixed leaf spring. Toward the wheel end the spring is braced by a vertical telescoping tube equipped with rubber doughnuts. The wheel is mounted to permit full "castoring."

The wing spars are of extruded I-sectioned dural, and all ribs are of stamped dural sheet with circular cut outs. The covering of the wing is of fabric with the exception of the flaps which on the present model consist of single sheets of flat dural riveted onto corrugated ones. It is planned to replace these with a similar structure of shot-welded stainless steel in future models.

The cabin has been exceptionally well equipped with windows, ahead, on the sides, and in the roof, the overhead curtain feature of the Monocoupe being adopted to provide protection from the sun when desired. Control sticks are of dural to eliminate compass interference. Rudder pedals are adjustable and have brakes attached. The instrument panel is rubber suspended against vibration and mounts bank and turn, rate of climb, and cylinder head temperature indicators in addition to the more common instruments.

Standard equipment includes motor-driven generator, electric starter, radio receiver, 12-volt storage battery, rotary converter to eliminate B batteries, landing lights, and an eighth horse power motor to operate the flap mechanism. Thus fully equipped and powered with the Super-Scarab, the plane is licensed for 65 lb. of baggage, two passengers, and sufficient fuel for 550 miles.

With the 145-hp. Super Scarab the plane is sold at $6,000. It is also offered with the 125-hp. Scarab, and the 90-hp. Warner Junior at prices down to $3,500.

Super-Waco

WITH the presentation of its D series this year the Waco Aircraft Company makes its first definite bid for the super-speed sport market. Originally developed as a military ship for export, the D is a two-place enclosed cockpit biplane retaining many of the external and structural features of other Waco models but specially designed throughout to withstand the increased loads and make the most of the performance which it develops when equipped with 420-hp. Wright or Pratt & Whitney engines.

Departing from general Waco practice the top wing consists of but two panels joining together at a shallow cabane above the fuselage. Pilot and passenger sit further aft than in the F models, the front seat being slightly to the rear of the upper wing. The turtle deck runs up to the rear of the "coupe" cockpit shelter and the entire fuselage is carefully faired to give aerodynamically favorable curvature. Like all other models the D is equipped with N.A.C.A. cowling and full wheel streamlining. The "coupe" top is of course equipped with sliding panels above each cockpit. Full attention has been paid to the fairing of strut ends, wing fillets and the transition regions between control surfaces and the fuselage. Full equipment includes radio, generator, landing lights and flares, and bank and turn, rate of climb, and cylinder head temperature indicators.

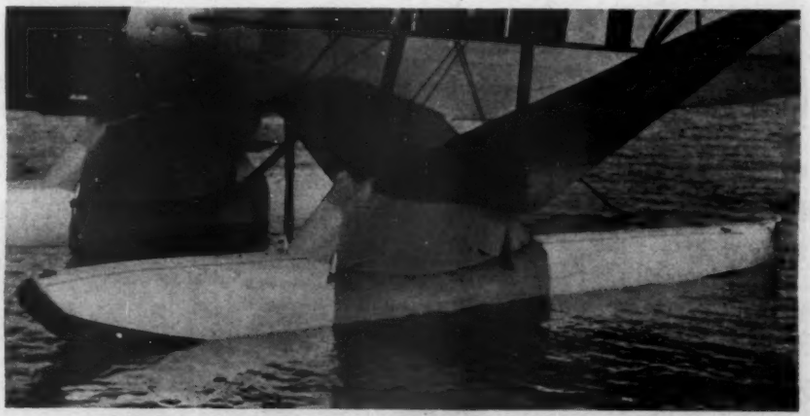
The D is offered powered with Wright engines from the 250-hp. to the 420-hp. model or Pratt and Whitney engines from 300-420 hp. Either the military or the commercial model of the D series is available mounted on Edo floats.

Equipped with a 420-hp. engine the commercial model has a top speed of 191 m.p.h., cruises at 166, lands at 56. With the 250-hp. Wright it has a top speed of 160 m.p.h., lands at 53. With an all-up weight of 3,400 lb. and with the larger engine it carries a useful load of 1,100 lb. and 87 gal. of gasoline, has an initial climb of 1,600 ft. per min., reaches a ceiling of 23,000 ft.

Bellanca Seaplane Aircruiser

ALTHOUGH the smaller Bellanca models have seen much service when equipped with seaplane floats, no attempt had ever been made until recently to utilize the performance and capacity of the Airbus for water operations. Convinced that a considerable field awaited such an aircraft, Bellanca designers have produced a Seaplane Aircruiser on Edo floats retaining many Airbus features and its excellent efficiency but in reality being a new airplane completely redesigned and specifically developed for seaplane service. Equipped with a Wright Cyclone 1820-F geared engine of 715 hp., the Aircruiser Seaplane has a maximum speed of 160 m.p.h. and a cruising speed of 145 m.p.h. when carrying fifteen persons. The first plane of this type has been awarded an A.T.C. license by the Bureau of Air Commerce and put into service on the commuting route operated by the New York and Suburban Airlines, Inc.

The Bellanca wing bracing and float



A view of the float attachment. The Bellanca struts lend themselves to ingenious mounting arrangement and convenient handling features.

The Percival Mew Gull participated in the recent King's Cup Races. The designer is at the controls.

strut system offers many opportunities for the incorporation of handling conveniences, such as storage compartments for anchor ropes, and provision for outboard motor attachment for use when taxiing close to shore or in congested harbors.

If desired, the Seaplane Aircruiser can be easily converted into a land plane by the substitution of a conventional wheel type landing gear. The factory is also prepared to offer the plane equipped for amphibion service, retaining the floats but adding a retractable land undercarriage which folds completely into the lower wing stubs when not in use. Designs have also been completed for the construction of the ship as either a seaplane or an amphibion but equipped with two engines for increased performance.

Caproni 114

THE CAPRONI 114 is a single-seated fighter designed specifically for high altitude work. A high aspect ratio biplane with upper and lower wings of equal span, it presents an exceptionally business like appearance throughout its design. While its structure is the orthodox welded-tube-fuselage, fabric-covered, wooden-wing type it has several interesting external features. The wide center section in the upper wing is matched by a stub wing construction in the lower panels. The split landing gear is noteworthy in having its axle and rigid brace member both carried to the center of the fuselage while the oildraulic absorber leg is carried to the lower longeron. Aerodynamic high lights are the large three-bladed propeller, the Townend ring cowl, large ailerons on all four panels, a nicely rounded fuselage, and wheel fairings.

It is armed with three machine guns, two forward, one to the rear, and is fitted with pressure fuel tank and special carburetor to permit inverted flight and aerobatics.

Equipped with a nine-cylinder Mercury IV 420-hp. engine it has a top speed at 16,000 ft. of 215 m.p.h., an initial climb of 2,800 ft. per min. and a radius of action of 360 miles.

Its specifications include: Span, 34 ft.; length, 24 ft. 2 in.; total wing area, 269 sq.ft.; weight, empty, 2,880 lb.; gross loaded weight, 3,660 lb.

The new Caproni 114 is designed specifically for high altitude fighting.

A New British Racer

REMINISCENT of Benny Howard's Mike and Ike, with a dash of Granville's Supersportser thrown in is Britisher Edgar Percival's Mew Gull first demonstrated at Gravesend on March 15. One prime objective in developing the design was to test the behavior of a new wing section developed from the Clark Y under extremely heavy loading. The results obtained from experimental work with the Mew Gull may in the future be translated into much larger machines to be produced in the Percival factory.

The Mew Gull is powered with a Napier Javelin six-cylinder inverted air-cooled engine of 160 hp. It is built of wood with plywood coverings except for the ailerons, elevators and rudders which are fabric covered over wooden frames. Landing gear is non-retractable, but is fitted with large streamline fairings of the type now used in many Percival designs. The high speed is reported to be over 200 m.p.h., cruising

Enclosure on Taylor Cub gives pilot protection, higher performance.

185 m.p.h. A decelerator, or air brake built into the fuselage helps keep the landing speed within reasonable limits. The span is 24 ft., wing area 78 sq.ft., gross weight 1,458 lb., giving a wing loading of about 19 lb. per sq.ft. and a power loading of 8.5 lb. per hp.

Taylor Cub with Enclosure

ALTHOUGH of basically similar design to prior models, the Aeromarine (AR3-40) powered Taylor Cub with cockpit enclosure shows performance figures considerably beyond those of its predecessors. Where open models hit a top speed of 80 m.p.h. and cruise at 65 m.p.h., the enclosed ships are reported to fly at 92 m.p.h., cruise at 85 m.p.h. Weight empty has been increased by 13 lb. to 538 lb. Licensed gross weight is 950 lb.

The enclosure design is simple, and reduces cockpit accessibility and pilot vision very little. On the right side the window section swings up, and the fuselage side swings downward, giving easy access to both front and rear seats. On the left, the central window panel is hinged at the top and may be swung open for ventilation or to improve the view from the pilot's seat. The tandem seats are designed for parachutes. Dual controls are fitted.

Fuselage, tail surfaces and landing gear are welded up of steel tubes. Stabilizer is adjustable. Wings have solid spruce spars, aluminum alloy ribs, trailing and leading edges. Drag system includes tubular metal struts and tie-rod bracing. Ailerons are fabricated of aluminum alloys. The entire ship, except for nose cowling, is fabric covered.

Standard equipment includes 7.00x4 balloon tires, dual controls, 9 gal. fuel tank, 1 gal. oil tank, baggage compartment, tachometer, altimeter, oil pressure and temperature gages.

The general specifications include: span, 35 ft. 2 in.; length, 22 ft. 6 in.; height 6 ft. 6 in.; total area, 184 sq.ft.; weight empty, 538 lb.; gross weight, 950 lb.

ECONOMICS OF AIR MAIL TRANSPORTATION, *by Paul T. David; The Brookings Institution; Washington, D. C., 1934, 235 pages; $2.*

THE result of a very exhaustive study undertaken in connection with the work of the National Transportation Committee. It combines the history of the air mail with a review of the situation of the industry and of its financial relations with the government as they existed immediately prior to the cancellation of last February, and concludes with the author's own recommendations for future developments. An excellent book for everyone interested in air transport economics to read and then keep within reach.

NOTEBOOK OF SIR GEORGE CAYLEY; *published for the Newcomen Society by W. Heffer & Sons, Ltd.; Cambridge, 1933; 93 pages; $2.25, approximately.*

STUDENTS of the early history of aeronautics have long reverenced Sir George Cayley, sixth baronet of that name, whom Dollfus and Bouché in their great history of aeronautics refer to as "the greatest technical figure in the first third of the nineteenth century and the true inventor of the airplane." To those students of the aeronautical art who feel an instinctive interest in things that happened before 1927 or even before 1903, the notebook can be recommended as good reading and sure to inspire the imagination.

THE AERONAUTICAL DIARY FOR 1934; *Gale and Polden, Ltd.; London.*

A VERY convenient little pocket-book, attractively bound in leather, containing a miscellany of useful information for those who expect to fly in the British Empire.

METHOD AND PROCEDURE IN FEDERAL PURCHASING, *by R. J. Monteith and A. S Burack; Bruce Humphries, Inc.; Boston, 1933; 349 pages; $10.*

PERHAPS this is a particularly good time for the aircraft industry, which as a whole depends so largely upon government business, to look into the general rules under which buying is done and to compare their own experience with that of suppliers in other departments. For lawyers and for a few executives of companies especially concerned with doing business with the government this book is likely to prove a handy one in spite of certain omissions, but it cannot be at all generally recommended to readers in the aeronautical field.

COST AND PRODUCTION HANDBOOK; *Edited by L. P. Alford; Ronald Press Company; New York, 1934; 1,544 pages; $7.50.*

WHEN an engineer thinks of a handbook, it is commonly a compilation of tables and constants and formulæ, perhaps with a little incidental instruction as to how they are to be used, that he has in mind. This is the other kind of handbook, and it would have been more accurate to call it an encyclopedia. It is really an all-inclusive textbook upon cost accounting from the point of view of the factory, cost estimation, and plant and personnel management and production records. One must dispose of its quality by the very general statement that the material is well selected and clearly presented and that the 28 main sections are on the whole logically arranged and given substantially their correct relative importance in amount of space.

RAPPORT DE LA PREMIER CONGRÉS INTERNATIONAL DE LA SECURITÉ AÉRIENNE, *Vol. IV; Comité Francais de Propagande Aéronautique; Paris, 1933; 242 pages.*

THIS is identical in form and general nature of content with the three preceding volumes (already reviewed in AVIATION) of the reports of the First International Congress on Aerial Safety, held in Paris in 1930. The present volume is devoted particularly to air transport and navigational problems and to aviation medicine, and among its 70-odd papers there are three of American sources.

PROCEDURE HANDBOOK OF ARC WELDING DESIGN AND PRACTICE. *Enlarged Edition, Lincoln Electric Company; Cleveland, Ohio, 1934, 454 pages; $1.50.*

A GENERAL study of the nature of the welding process and of welding technique, but with no special relation to aircraft. Deals mostly with mild steel though the characteristics of chrome-molybdenum and other materials are also briefly discussed.

INTERNATIONAL INDEX TO AERONAUTICAL TECHNICAL REPORTS; *Prepared by the Society of British Aircraft Constructors; Royal Aeronautical Society; London, 1934; 131 pages; $1.25 approximately.*

THIS book covers 1932 only, and is divided into two approximately equal parts, the one covering British and

American publications and the other taking in the rest of the world. There is a total of somewhere around 1,200 references, and they are conveniently arranged by subjects and well indexed.

TECHNICAL REPORT OF THE (BRITISH) AERONAUTICAL RESEARCH COMMITTEE 1932-33; *two volumes; H.M. Stationery Office; London, 1934, 1,548 pages total, approximately $11, volume I, $12, volume II.*

THE customary comprehensive record of a year's research work under British Government supervision. Like the N.A.C.A., British laboratories have been concentrating particularly on interference and on regions of unstable and irregular behavior. Buffeting and flutter get seven reports, covering almost 200 pages, while stability and spinning receive even more space. Reminders of the trend of British thought on power plants are found in a series of particularly extended reports on engine cooling by water and by steam, upon oil cooling, and on supercharging problems. Structural studies have related mostly to elasticity and its effect on flutter and seaplane behavior has received much less attention than in previous years. This volume brings the twenty-year long series of reports and memoranda up through No. 1535.

WIND TUNNEL INTERFERENCE ON WINGS, BODIES AND AIRSCREWS, *by H. Glauert, F.R.S.; H.M. Stationery Office; London, 1933, 75 pages, $1.60 approximately.*

A STUDY of the behavior of models of airplane parts in the wind tunnel and of the differential between the conditions prevailing there and those of free flight. The correction factors best to be used for wind tunnel wall effect are studied and a number of formulas developed for special cases. Glauert's report may well be read in conjunction with the work of Theodorsen at Langley Field on the same subject.

I.C.S. AVIATION ALTITUDE AND AZIMUTH TABLES, *designed by E. B. Collins in collaboration with Capt. E. K. Roden; International Text Book Company; Scranton, Pa., 1934, 90 pages; $2.*

THE customary collections of figures and explanation of their application. Every user of the methods of celestial navigation has his own idea as to convenience in arrangement and will have to investigate these tables for himself, comparing them with others he has known. They possess some points of convenience though the pages are somewhat congested and the typography and printing are poor enough to handicap quick and accurate use.

THE ENGINE INDICATOR, ITS DESIGN, THEORY AND SPECIAL APPLICATIONS, *by Kalman J. DeJuhasz; New York Instruments Publishing Company; New York, N. Y.; 1934, 235 pages; $3.75, including a year's subscription to Instruments.*

A STUDY in theory and in practice of some 30 types of indicator specially designed for high speed internal combustion engines. A useful manual for workers in the engine laboratory.

RAKETENFLUGTECHNIK, *by Dr.-Ing. Eugen Sänger; R. Oldenbourg; Munich and Berlin, 1933, 231 pages; $3.40, approximately.*

A GENERAL treatment of the theory of jet propulsion or "rocket flight." A careful treatment and one not too profound and mathematical for the average engineer to read.

LE VOL VERTICAL, *by Lt.-Col. Lamé; Blondel La Rougery; Paris, 1934; 239 pages; $4.50 approximately.*

HISTORY, general theory, and the practical record of the helicopter, including a careful study both of sustentation and stability and descriptions of some 26 designs. Undoubtedly the best book on the subject.

FUNDAMENTALS OF HYDRO AND AEROMECHANICS, *and* APPLIED HYDRO AND AEROMECHANICS, *written by Dr. O. G. Tietjens from the lectures of Dr. L. Prandtl of Göttingen; two volumes; McGraw-Hill Book Company, Inc., 330 West 42d Street, New York, N. Y., 1934, 311 and 265 pages respectively; $4 each.*

GENERAL text on hydrostatics and hydro-dynamics, including cases of air and other compressible fluids. The name of the lecturer from whose classroom notes they were written is a sufficient guarantee of the outstanding quality, and the translation is clear and careful. The second volume contains most of the specifically aerodynamic material including 80 pages of air foil theory, but the first supplies the necessary foundation of general mathematical physics.

METAL AIRCRAFT CONTRUCTION, *by M. Langley; Pitman Publishing Corporation, 2 West 45th Street, New York, N. Y., 1934, 331 pages; $4.50.*

THE second edition of one of the best of all books on detail design proves even better than its predecessor. With more than 300 illustrations, many of them from sketches of aircraft parts, it is an invaluable manual. It still seems a little light on American practice but the author explains in the preface, and this reviewer happens to know, that that was not for want of trying but because most American firms refuse to furnish any such structural data as European designers provided.

THE WAR IN THE AIR, *by H. A. Jones; Oxford University Press, 114 Fifth Avenue, New York, N. Y., and London, 1934, 484 pages; $7.*

VOLUME FOUR of the greatest of all histories of military air operations is devoted to British naval aviation and to the western front operations of 1917 and early 1918. As well and carefully written as its predecessors; its narrative is supported by many maps and citations of official record.

TASCHENBUCH DER LUFTFLOTTEN, *by Dr.-Ing. Werner v. Langsdorff; J. F. Lehmanns Verlag; Munich, 1934, 310 pages; $4, approximately.*

ANOTHER edition of a familiar compilation. It appears in a single volume this year in place of the three of the preceding edition but it satisfactorily illustrates the principal types of all the major nations and tabulates their characteristics. A handy manual for use where "All the World's Aircraft" is too bulky to keep within reach.

THE AIR MENACE AND THE ANSWER, *by Elvira K. Fradkin, A.B., M.A.; Introduction by James T. Shotwell; The MacMillan Company, 60 Fifth Avenue, New York, N. Y.; 332 pages; $3.*

HISTORY and the prospects of military aviation, studied from the special point of view of its combination with chemical warfare and of its relation to the limitation of armaments and the attempts to organize peace. Written from the point of view of a worker for international peace on lines realistic rather than imaginative, it contains much of interest to students of the application of air armaments.

THE VILDEBEEST AEROPLANE *(Pegasus L.M. Three Engine), Air Publication 1439, Volume 1, second edition, February, 1933; Air Ministry, H.M. Stationery Office, London; 81 pages; 90 cents, approximately.*

ONE of those exceptionally thorough and well illustrated manuals of rigging and maintenance in which the British Air Ministry specializes. This particular machine is a torpedo carrying biplane, with Bristol Pegasus engine.

AIRCRAFT AT WORK

Yankee Dope Peddler

THIS department has long been interested in the use of airplanes by the traveling executives and salesmen of various industries. Over the past four or five years we have reported such use of flying equipment by almost every type and description of industrial or sales enterprise. Few however have seemed so fundamentally logical as the sales campaign by airplane carried out by the Merrimac Chemical Company of Everett, Mass., a division of Monsato Chemical. Three years ago they decided to enter the airplane and lacquer market with a line of their own products. At the same time they came to the remarkably simple conclusion that the best method of aproaching prospective users of airplane dope was by airplane. Airplane factories are almost universally equipped with adjacent landing fields. The ease of the airplane approach to the maintenance departments of airlines and operating companies is even more obvious. The result was the purchase of a Lycoming powered Stinson and the assignment of the industry at large to salesman-pilot John Worthington, who has been flying his territory at the rate of 50 hours a month ever since.

His plane is his flying sample case, since the first move after its purchase was to have it finished at the factory in a completely Merrimac dope job topped off a dazzling buff. There is hardly an important airport in the country which has not seen it.

The dollars and cents success of the operation we do not know. At least the company has seen fit to continue it in the face of the slackness of business generally. What is important is that it has proven beyond question the correctness of the initial preface that there is no better way to approach the aeronautical supply and accessory market than by airplane. We can call to mind the effective "flying laboratories" of one or two instrument manufacturers and the deliberately astounding performances of a test plane demonstrator belonging to an airplane tire manufacturer. There are many other possible uses of this sound idea.

New Insects to Conquer

IF the ancient Egyptian Pharaoh of the book of Exodus had had an adequate air force at his command, the plague of locusts called up by one Moses would not have assumed such formidable proportions. Report comes that the authorities of present-day Egypt have in any case developed an effective aerial counter attack against the locust hordes that still wreak such havoc on the crops of the Nile Valley. The general plan of campaign is the result of the combined staff work of government entomologists, the chemical warfare board, and the aerodynamicists of the Farnborough laboratories. From planes leased from the Imperial Airways, clouds of finely powdered sodium arsenate are released directly across the flight path of the approaching swarms.

From two points on our own continent come further reports of the effective use of aircraft against a different but no less devastating insect plague, the grasshopper. When large swarms of these insects appeared this spring in certain sections of Colorado, Maj. V. D. Stone, of the Colorado National Guard, made up a poisonous mixture of bran mash and distributed it over the affected areas from an airplane. Results were so satisfactory that Dr. George M. List, entomologist for the Colorado Agricultural College, announced that further experimental work would be undertaken at once, using improved apparatus designed to scatter the poison in an even more effective manner. Almost identical developments were simultaneously taking place in the Drumheller and Hussar sections of the Canadian province of Alberta, where the grasshopper is also a perennial pest.

With such items coming in from scattered parts of the globe to be added to the record of the aerial warfare against the boll weevil, the mosquito, and a score of other insect forms which infest our trees and plants, the airplane seems assured of an increasingly important rôle in a battle which may some day assume major proportions, as permanent programs of conservation develop.

IT TAKES ALL KINDS

of transportation to conduct mining operations in New Guinea, but the airplane remains the basic vehicle. A Dodge roadster going into one of the Junkers freight planes of the Bulolo Gold Dredging Company, Ltd.

Show Business

WITH the ground well prepared by a barrage of newspaper advertising and general publicity, Earl Carroll, veteran showman and one-time military pilot, made a fast cross-country trip in a Lockheed cabin monoplane recently, stopping at key cities en route, to give previews of his latest movie, "Murder at the Vanities." Showings were given in eleven principal cities within three days, beginning with San Francisco, Salt Lake City, and Denver; Kansas City, St. Louis and Chicago; Detroit, Cincinnati and Pittsburgh, winding up with a midnight performance in New York. A side trip to Boston was made on the following day. The trip furnished ample demonstration of the value of a high-speed airplane in distributing films, samples (and, of course, publicity) over a wide area in a short time.

THE BUYERS' LOG BOOK

AVIATION'S *Card Index of New Equipment*

This department is equipped to help readers locate manufacturers of any parts, accessories or materials

AIRPLANE ACCESSORIES — **Cameras (catalogue)**

Fairchild Aerial Camera Corporation,
Woodside, N. Y.

A COMPLETE catalogue of Fairchild products, this truly beautiful book contains detailed descriptions of all cameras, photographic equipment, and accessories manufactured by the company and many examples of aerial photography. Since its printing cost was very high, it is to be distributed free only to responsible officials who request it. Price to others, $4.

AVIATION, *September, 1934*

MATERIALS — **Aircraft gaskets (catalogue)**

The Vellumoid Company,
Worcester, Mass.

CATALOG A-5 issued June 1 of this year lists gives prices for gaskets either individually or by set for more than two dozen aircraft engines. In addition to Vellumoid Gaskets are listed copper, asbestos, cork, rubber, and fibre items whenever called for in various designs, thus offering a complete gasket service designed particularly for the aircraft engine repair depot.

AVIATION, *September, 1934*

MATERIALS — **Rust-proofing process**

The Curtin-Howe Corporation,
New York, N. Y.

A PROCESS of rust-proofing developed by Dr. L. P. Curtin for Western Union Telegraph Company has been made available to the metal industry. Treatment consists of dipping parts into solution of Loxal. The powder and solvent are mixed in iron tank maintained at 150 deg. F. Parts are dipped and dried in air. Treatment used as base for paints, lacquers, etc.

AVIATION, *September, 1934*

MISCELLANEOUS — **Aviation maps**

International Map Company, Inc.,
90 West Street, New York, N. Y.

MANY pilots setting out on trans-Atlantic, or other distance flights over foreign territory have carried International maps. A general index map is available from which detailed maps of specific territories may be selected. Maps are published in colored or uncolored editions in scales ranging from 1:100,000 to 1:2,000,000. Certain French and British maps also in stock.

AVIATION, *September, 1934*

SHOP EQUIPMENT — **Cabinets (catalogue)**

W. C. Heller and Company,
Montpelier, Ohio

A WIDE range of cabinets suitable for the storage of bolts, screws, and small parts is described in Form No. 8742 prepared especially for the airport, machine shop and factory. Most of the cabinets listed provide for incorporation with other units to meet special requirements and for optional subdivision of individual drawers. An assortment of tool brackets is also offered.

AVIATION, *September, 1934*

SHOP EQUIPMENT — **Electric drill**

Stanley Electric Tool Company,
New Britain, Conn.

FOR light drilling, buffing, wire brushing, etc. in shop or hangar, the Stanley No. 14 Junior electric drill has been developed. Has three-jawed chuck with capacity up to ¼ in. Equipped with universal motor (15,000 r.p.m. at full load) to operate on either D.C. or A.C. (60 cycles) on all popular voltages. Control switch in handle. Fitted with heavy rubber covered cable.

AVIATION, *September, 1934*

SHOP EQUIPMENT — **Hypressure Jenny**

Homestead Valve Manufacturing Company,
Corapolis, Pa.

HYPRESSURE JENNY portable and stationary units are used at many airports and overhaul shops for cleaning airplanes, engines and parts. A new fireless model has just been introduced, designed to use plant steam for vaporization of cleaning compounds instead of usual integral oil-fired boiler. It is quite compact and easily portable. 20x45x52 in.

AVIATION, *September, 1934*

SHOP EQUIPMENT — **Oxygen generator**

Linde Air Products Company,
30 East 42d Street, New York, N. Y.

OXWELD type MP-4 acetylene generator is intended for portable use in shop or field to replace bottled gas. It has a capacity of 150 lb. of quarter size carbide. It will produce 300 cu.ft. of acetylene per hr. The unit is 87 in. in overall height, 42¾ in. in diameter. It weighs 750 lb. empty and, fully charged, weighs 2,250 lb. Oxweld R-56 regulator built-in.

AVIATION, *September, 1934*

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